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# Leafhoppers (Homoptera: Cicadellidae) of Canada and Alaska

*by*

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# Leafhoppers (Homoptera: Cicadellidae) of Canada and Alaska[1]

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## Introduction

The main objectives of this work are to list the species of leafhoppers that have been found in Canada and Alaska, to summarize available information on their bionomics and distributions, and to define the chief taxonomic characters so that specimens may be named without necessarily a knowledge of the systematics of the group.

DeLong and Knull (1945) listed under 170 species known to occur in Canada or Alaska. Four hundred and eighty species are discussed below. In this study a number of new species were discovered. Twenty-five of these have been described elsewhere, by the author or others, and are included below; and the remainder, most of which are species of *Empoasca* or *Erythroneura*, await description when the groups to which they belong are revised. In addition, some 105 names that were previously treated as valid specific names have been definitely or tentatively reduced to synonymy, either in earlier papers (Beirne 1950-5) or in the present work.

There are good reasons to believe that more species than those discussed below occur in Canada or Alaska. Therefore, any specimens that, after genitalic examination, are not found to agree with the descriptions and figures should be sent to specialists for examination.

Though this work will become out of date as a result of new discoveries, it includes the vast majority of species likely to be found in general collecting or in field work on economic projects; for the material on which the study was based was collected largely in these ways and the collections made in recent years rarely included specimens new to the country.

## Acknowledgments

Valuable assistance was received in the preparation of this work, or in the special studies that were made on certain groups, from various workers, to whom I wish to express my sincere thanks. Dr. D. A. Young, Entomology Research Branch, United States Department of Agriculture, Washington, D.C., provided much assistance with many problems, in particular with the genus *Empoasca*. Dr. P. G. Christian, University of Louisville, Kentucky, identified specimens of the genus *Typhlocyba* (sensu lato); Dr. J. T. Medler, University of Wisconsin, specimens of the genus *Scleroracus*; Dr. M. W. Nielson, Oregon State College, specimens of the genus *Colladonus*; and Dr. H. H. Ross, Illinois State Natural History Survey, specimens of the genus *Erythroneura*. Mr. J. F. Brimley, Wellington, Ontario, Mr. W. Downes, Victoria, British Columbia, and Mr. W. L. Putman and Mr. J. H. H. Phillips, Entomology Laboratory, Vineland Station, Ontario, provided many specimens for examination and, from their extensive experience in field work on leafhoppers, much new distributional, host-plant, and life-cycle data. Specimens were lent for examination, or other assistance was provided, by: Dr. N. H. Beamer, University of Kansas; Dr. W. E. China, British Museum (Natural History), London, England; Dr. D. M. DeLong, Ohio State University; Dr. D. J. Knull, Ohio State University; Mr. G. A. Moore, Redpath Museum, McGill University, Montreal; Dr. P. W. Oman, Entomology

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Research Branch, United States Department of Agriculture, Beltsville, Maryland; Dr. F. Ossiannilsson, Lund, Sweden; Dr. H. H. Ross; Dr. G. A. Strickland, formerly of the University of Alberta; and Dr. W. Wagner, Hamburg, Germany. Special collections of leafhoppers were made by: Dr. H. R. McCarthy, Entomology Laboratory, Kamloops, British Columbia; Dr. D. B. Waddell, formerly of the Entomology Laboratory, Summerland, British Columbia; Professor G. J. Spencer, formerly of the University of British Columbia; collectors of the Northern Insect Survey, a joint project of the Entomology Division, Department of Agriculture, and the Defence Research Board, Department of National Defence; and members of the staff of the Systematic Entomology Unit, Ottawa.

## Types of Distribution

Most of the 480 species under discussion have their centres of distribution in North America in the United States and reach their northern limits somewhere in Canada. The ranges of most of those that have their centres of distribution in Canada extend southward into the United States, particularly in the East and in the mountains of the West. A few species have been found in North America only in Canada or in Alaska.

The largest numbers of species occur in the warmest sections of the country: in the southern parts of British Columbia and Ontario. A number have been found only in those regions. The distributions of a larger number cover much or all of the deciduous forest region of Ontario and Quebec (referred to below as southern Ontario and southern Quebec, respectively). Many species have been found only in the grassland (parkland, or aspen grove, and prairie) regions of Alberta, Saskatchewan, and Manitoba. Too little is known of the distributions in British Columbia—a complex region, zoogeographically—to enable any definite conclusions to be reached at present on distribution patterns there; there are indications, however, that some species are restricted to the southwest, with their centre of distribution in the south of Vancouver Island, some are restricted to the dry valleys of the interior, and some are restricted to the mountains. A number of species have more or less transcontinental distributions and are confined to or have their centres of distribution in the Boreal (coniferous) forest region, though few of them feed on conifers. The distributions of many of these extend northward into the Transitional, or Subarctic, zone, some as far as, or even onto, the margins of the Arctic tundra; and the distributions of some extend southward in the mountains of the West. Only one species, *Psammotettix lividellus* Zett., is definitely known to be a permanent inhabitant of the tundra far north of the tree-line.

About 21 per cent of the species have transcontinental distributions in that they occur from Alaska or British Columbia at least as far east as Ontario. About 29 per cent have been found only in the East, in Ontario, Quebec, or the Atlantic Provinces. About 17 per cent have been found only in the Prairie Provinces, most of them in the grassland regions. About 18 per cent have been found only west of the Rockies. About eight per cent, mostly species associated with deciduous trees or shrubs, occur in the East and in the Prairie Provinces but not in or west of the Rockies, and a similar percentage, mostly grassland species, occur in the Prairie Provinces and the interior of British Columbia but not in the East. A total of about 58 per cent of the species have been found in the East, about 44 per cent in the Prairie Provinces, and about 48 per cent in or west of the Rockies. About 17 per cent have been found in Alaska, Yukon, Northwest Territories, and Labrador, and about two per cent are confined to those regions.

About 14 per cent of the species also occur in the Palaearctic region. About one-third of these are known or suspected artificial introductions but the distri-

butions of the remainder probably are natural. The majority of the probable artificial introductions have deciduous trees or shrubs as host plants and occur in the more southern parts of Canada, whereas most of the species whose Holarctic distributions are probably natural have grasses or herbaceous plants as hosts and northern and western or Boreal distributions.

Leafhoppers have been collected in many parts of Canada and Alaska but relatively few areas have been worked intensively and there are large areas from which little or no material was available for study. The major regions in which the least collecting seems to have been done are: Prince Edward Island, western Ontario, northern British Columbia, Newfoundland, Alaska, Nova Scotia, northern Saskatchewan, and northern Alberta, approximately in that order. Species new to the fauna are most likely to be discovered in southern British Columbia and southern Ontario.

**Bionomics and Economic Significance**

A few species of leafhoppers live on the ground among roots of plants, but the great majority are free-living on the foliage. The nymphs of each species are restricted to one or a few species of host plants but the adults often have a variety of food plants. About 30 per cent of the species dealt with here apparently have grasses or sedges as host plants, about 16 per cent other herbaceous plants, and about 33 per cent woody plants. Host plants of the remainder are unknown. Few species feed on conifers, either as nymphs or as adults. The host plants and the food plant preferences of a considerable number of species are not positively known. In general, the leafhopper fauna of grasses and herbaceous plants is better known than that of woody plants.

The eggs are laid in plant tissues and there are five nymphal instars. The adults are normally bisexual, though *Agallia quadripunctata* Prov. reproduces parthenogenetically. The adults, particularly the males, produce courtship and other calls. There are one or more generations a year depending on the species and on the climate. Some species, for example, *Macrosteles fascifrons* Stål, pass one generation on one kind of host plant and others on another. Development of some species can be rapid, and heavy local populations may build up. Most species apparently hibernate as eggs, many as adults, in dead leaves or other debris, and a few as nymphs. At least one, *Empoasca fabae* Harr., is unable to survive the winter in Canada but migrates northward from the United States in early summer. Many are active fliers and the smaller species are readily carried by winds. They fly mainly in warm, windless weather. Some species are active in the sunshine, some in the evening, and some after dark.

Parasites of leafhoppers are Dorialidae (= Pipunculidae) (Diptera), Dryinidae (Hymenoptera), and Strepsiptera. The incidence of parasitism may be high but normally appears to be low or very low. Weather may normally be the chief factor in the natural control, though little definite information is available. There are indications that heavy rain may cause severe mortality to many species, particularly in the early nymphal stage. Conversely, dry weather seems to be favourable to many, unless the host plants or food plants are affected detrimentally. The activity of leafhoppers under windless conditions and their relatively greater abundance in sheltered than in exposed situations indicate that the amount of wind may be an important factor in the control of many species. As the nymphal period of most species is short, favourable conditions at that time may result in a rapid increase in abundance.

Leafhoppers feed by piercing plant tissues and sucking the juices. They can cause serious damage when abundant. Species that regularly cause such

damage to economic plants in Canada include *Empoasca fabae* Harr., on potato, alfalfa, beans, and other plants; *Erythroneura comes* Say, *E. tricincta* Fitch, and *E. vulnerata* Fitch, on grape; *E. ziczac* Walsh, on Virginia creeper; *Macropsis fuscula* Zett. and *Typhlocyba tenerrima* H.-S., on cultivated forms of *Rubus*; and *Empoasca maligna* Walsh, on apple. The amount of damage caused by the species that feed on grasses or on deciduous trees and shrubs can only be surmised.

Most species feed on the mesophyll tissues. This produces a mottling or spotting of the leaves. In severe attacks the leaves become partly or wholly withered and may fall prematurely. The attacks may impair the vitality of the plants and, with fruit trees, reduce the size and quality of the fruit. Some species, of which *Empoasca fabae* is the best-known example, cause more serious damage as they attack the phloem, rather than the mesophyll, tissues. Extensive injury, known as hopperburn, may result to the plants.

The direct damage caused by leafhoppers is outweighed in economic significance by that caused by the virus diseases that they transmit to plants, and 20 of the species found in Canada are known to be vectors of virus diseases of economic plants in North America. There is little doubt that this total will be increased by future work. The diseases are apparently transmitted to the economic plants either by individuals associated with those plants that have fed casually on infected plants of other kinds or by individuals associated with the other kinds of plants that feed casually on the economic kinds. Because of this, effective control of the diseases by artificial control of their leafhopper vectors is at present rarely economically practical.

## Collecting and Preparing

The best way to collect leafhoppers is to pick individual specimens from individual species of plants with an aspirator. This often provides the host plant or food plant data that are useful with every species and essential if some are to be named. Nymphs with associated adults are valuable in view of the paucity of such material in collections. Sweeping produces leafhoppers in large quantities; and many species, including some rarely captured by other means, may be obtained in light traps.

Specimens may be killed with cyanide or ethyl acetate. They should be preserved dry; preservation in alcohol is undesirable but not unsatisfactory. They should be mounted in the customary fashion on card points. No species of leafhopper found in Canada is too large to be mounted on a point; none need be pinned directly through its body. If specimens cannot be mounted before they have dried, they may be stored in pill boxes between layers of cellucotton or facial tissue.

If a specimen is mounted correctly, so that the tip of the point is attached with the adhesive to the underside of the right side of the thorax and not to the head, wings, legs, or dorsal surface, the external characters, including the female seventh sternum (the last sternum before the ovipositor), can be examined readily without further treatment.

The male genitalia are prepared for study as follows:—The abdomen is removed by pressure with a needle at its base, or its apical part is cut off carefully with fine forceps or scissors. It is placed in a ten per cent solution of caustic potash either in a short, wide vial which is left for a few hours or overnight in a closed Petri dish, or in a dish that can be heated on a hot plate until the solution is warm (but not boiling). The former is preferable as the genitalia are less liable to damage. The abdomen is removed from the caustic solution, washed in water, and examined with a microscope. At this time any liquefied soft parts

that remain may be expelled from the abdomen by gentle pressure with a needle. The abdomen is then placed in a very small drop of glycerine in the bottom of a microvial (4 by 10 mm.). The microvial is transfixed through its cork by the pin of the specimen from which the abdomen was taken. For examination, the abdomen is picked from the microvial and placed in glycerine on a cavity slide. With a little practice such preparations may be made quickly, especially if a number are made at the same time. Species can usually be identified more easily by preparation and examination of the internal male genitalia than by study of external characters. It is usually not necessary to stain the genitalia.

**Taxonomy**

More than two-thirds of the North American species of leafhoppers were first described only since 1920, half of these between 1930 and 1939. This phase of taxonomic study—the description of new species in large numbers, frequently on limited quantities of material—is being supplanted in recent years by one of a more intensive study of a wider range of taxonomic aspects. With the application of new taxonomic concepts and the availability of relatively large quantities of study material, it is becoming increasingly evident that individual, environmental, seasonal, and geographical variation in colour, markings, and size, and sometimes in structural characters, frequently exists within species. As a result, many names previously considered to apply to valid species are being reduced to synonymy.

In general, specimens from cold or wet areas or situations are relatively darker and more strongly marked than specimens of the same species from hot or dry areas or situations. Variation often is particularly extensive in species that are common, that have wide distributions, and that either, like *Empoasca fabae* Harr., *Macrosteles fascifrons* Stål, *Scaphytopius* (*Cloanthanus*) *acutus* Say, and *Aceratagallia sanguinolenta* Prov., occur in a variety of types of habitat and have a variety of host plants, or that, like species of *Xerophloea*, *Cicadula*, and *Palus*, have host plants that are very widely distributed.

The groups in which it is most difficult to define the limits of the species are those groups of *Idiocerus*, *Macropsis*, and *Empoasca* whose host plants are species of *Salix* or *Populus*. These groups each contain a number of forms that differ from one another in colour and markings and that in the past have been treated as valid species. However, these forms intergrade in external morphological characters, even in single populations, and differ little or not at all in genitalic characters. In the following, such groups of forms are mostly treated as polymorphic species, pending a more accurate definition of the status of each form that may become apparent from life-history studies or breeding experiments. It seems most probable that such forms are incipient species that can still interbreed. The host plants of these polymorphic species are often plant groups in which the species limits tend to be ill-defined, indefinite, and controversial. Other species of *Idiocerus*, *Macropsis*, and *Empoasca* that feed on plants in which the species limits are well defined have themselves well defined morphological specific characters.

In some instances it is possible that forms that are at present treated as single species, for example, *Agalliopsis novella* Say and *Graphocephala coccinea* Forst., are in fact two or more closely-related species with different host plants.

Taxonomic characters used at present are largely morphological characters of the adults. Little is known of the taxonomy of the early stages. Characters of the genera and higher categories are based primarily on the general form and structure, particularly of the head, on the wing venation, and on the internal male

genitalia. At the specific level, the internal male genitalia and the female seventh sternum assume greater general importance. A considerable number of species can be identified only by examination of these structures, and in most species these structures show the most reliable specific characters.

The characters of the genera and higher categories of the North American leafhoppers were described by Oman (1949), whose work may be consulted for more detailed descriptions than are given here and for references to the original descriptions of the species. Recent revisions of individual genera or other groups are referred to in the appropriate places of the following text. Such revisions usually include North American species additional to those discussed here, and more detailed specific descriptions. The *Zoological Record, Part Insecta*, should be examined for such works published after 1954. At time of writing, revisional studies are in progress on some genera, notably *Idiocerus*, *Empoasca*, and *Colladonus*. When published, these revisions should be consulted when identifications are being made of species of the genera concerned. A number of works on the leafhopper faunae of large geographical regions contain keys to and descriptions of the species, genera, and higher categories, usually with figures. These may be consulted for information on species not discussed here. Such works are by DeLong (1948), on the leafhoppers of Illinois; Medler (1942), on the Minnesota species; Osborn (1928) and Johnson (1935), on the Ohio species; Lawson (1920), on the Kansas species; DeLong (1923), on the Connecticut species; Lathrop (1919), on the South Carolina species; and Osborn (1915), on the Maine species. Recent important European works are by Ribaut (1936, 1952) – which is particularly well illustrated – on the French fauna; Ossiannilsson (1946, 1947), on that of Sweden; and Wagner (1939), on that of Germany. Published literature on leafhoppers on a world basis was listed and classified by Metcalf (1942).

### Notes on the Text and Illustrations

The classification of the genera and higher categories is based on that of Oman (1949) for most groups and on those of Young (1952) and Christian (1953) for Typhlocybinae.

The descriptions given below mainly supplement the information given in the keys and figures. The figures of the whole insects are drawn to the same scale; the magnification is approximately X10. When comparisons are made between specimens and these figures, allowanoe should be made for variation in colour and markings. The figures of the genital structures are not drawn to constant scale. External structural characters mentioned in the text are shown in Figs. 1-3 and structures of the typical male genitalia in Figs. 813 and 814. Names of the structures shown are not given on the figures of the male genitalia of the individual species, as the identities of these structures are apparent when the genitalia are examined. The great majority of the figures of the male genitalia show the aedoeagus in lateral and–depending on its degree of curvature–ventral, posterior, or posterodorsal view. The connective is shown when it is fused to the aedoeagus, and in a few other instances. A majority of the figures include one of the styles and a large number include the apical (posterior) region of the pygofer. In some of the figures other structures that are of systematic significance are shown, for example, a downward projection of the tenth segment, known as the anal hook, in species of *Empoasca*, and accessory processes, or paraphyses, of the aedoeagus or connective in *Scaphytopius*, *Scaphoideus*, and some other genera.

The distributional information is based largely on specimens examined by the author. The distributions are described only in broad terms. More detailed

information can be included in provincial or other local lists. Examples of such lists are that by Downes (1927, 1935), for British Columbia; Moore (1950), for Quebec; and Strickland (1953), for Alberta. The distributions are described in the following by reference to the major political regions, which are subdivided as described in the foregoing section on distribution.

Some species that have been recorded are omitted in the following, as Canadian specimens either could not be obtained for examination or, on examination, proved to have been misidentified.

**Key to Superfamilies and Families of Auchenorhynchous Homoptera**

1. With two or no ocelli ..... 2
   With three ocelli arranged in a triangle ..... Family Cicadidae (cicadas)
2. Antennae arising between the eyes ..... 3
   Antennae arising beneath the eyes ..... Superfamily Fulgoroidea (fulgorids)
3. Pronotum not greatly enlarged or prolonged above the abdomen and with no part of it vertical ..... 4
   Pronotum greatly enlarged, prolonged above the abdomen, and with its anterior part vertical ..... Family Membracidae (treehoppers)
4. Hind tibiae without setae, with a few stout spines ..... Family Cercopidae (froghoppers)
   Hind tibiae with two rows of numerous stout setae ..... Family Cicadellidae (leafhoppers)

**Key to Subfamilies of Cicadellidae**

1. Ocelli not on vertex ..... 2
   Ocelli on vertex ..... 3
2. Ocelli on or close to margin of vertex, or absent ..... 9
   Ocelli on face ..... 17
3. Head, pronotum, and forewing with numerous large, circular pits ..... Ledrinae (p. 12)
   Head, pronotum, and forewing without such pits (except in *Helochara*) ..... 4
4. Frontal sutures ending at antennal pits (Fig. 10) ..... 5
   Frontal sutures ending at or near ocelli (Fig. 11) ..... 6
5. Face concave in profile (Fig. 15) ..... Penthimiinae (p. 30)
   Face flat or, usually, distinctly convex in profile ..... Iassinae (p. 26)
6. Face with distinct ledge above antennal pit (Fig. 11) ..... 7
   Face without distinct ledge above antennal pit (Fig. 12) ..... 8
7. Ledge above antennal pit oblique (Fig. 9) ..... Neocoelidiinae (p. 32)
   Ledge above antennal pit transverse (Fig. 11) ..... Aphrodiinae (p. 30)
8. Clypellus large, broad basally, narrowed and rounded distally; usually large insects ..... Tettigellinae (p. 33)
   Clypellus not as above; a very large group of usually small or moderate-sized insects ..... Deltocephalinae (p. 61)
9. Elongate, flattened insects with head greatly flattened and at least 1½ times as long as wide ..... Dorycephalinae (p. 12)
   Not as above ..... 10
10. Frontal sutures ending at antennal pits (Fig. 10) ..... Iassinae (p. 26)
    Frontal sutures ending at or near ocelli (Fig. 12) ..... 11
11. Distance between ocelli less than that between antennal pits ..... Coelidiinae (p. 30)
    Distance between ocelli equal to or, usually, greater than that between antennal pits 12
12. Clypeus expanded laterally over base of antenna to form deep antennal pit (Fig. 13); small, robust insects ..... Xestocephalinae (p. 32)
    Clypeus not expanded laterally to form deep antennal pit ..... 13
13. Face with distinct ledge above antennal pit ..... 14
    Face without ledge above antennal pit ..... 15
14. Ledge above antennal pit oblique (Fig. 9) ..... Neocoelidiinae (p. 32)
    Ledge above antennal pit transverse (Fig. 11) ..... Aphrodiinae (p. 30)
15. Forewing with veins indistinct basally and without crossveins before the apical crossveins; small, fragile, macropterous insects; ocelli often absent—Typhlocybinae (p. 38)
    Forewing with veins distinct basally and usually with one or more crossveins before the apical crossveins; small or moderate-sized, relatively robust, often brachypterous insects; ocelli usually present ..... 16
16. Margin of gena below the eye strongly sinuated (Fig. 8); insects distinctly dorsoventrally flattened ..... Hecalinae (p. 12)
    Margin of gena below the eye not strongly sinuated; insects not dorsoventrally flattened ..... Deltocephalinae (p. 61)

17. Frontal sutures ending at antennal pits (Fig. 7) ..... 18
Frontal sutures ending at or near ocelli (Fig. 5) ..... 19
18. Distance between ocelli equal to or greater than twice that from ocellus to eye (Fig. 6); vertex obtusely pointed; pronotum with striae; hindwing with three apical cells ..... Macropsinae (p. 16)
Distance between ocelli not over twice that from ocellus to eye (Fig. 7); vertex broadly rounded; hindwing with four apical cells ..... Agalliinae (p. 13)
19. Distance between ocelli less than that between antennal pits (Fig. 4) ... Idiocerinae (p. 21)
Distance between ocelli greater than that between antennal pits (Fig. 5) Kobeliinae (p. 30)

### Subfamily Ledrinae
### Tribe Xerophloeini
### Genus *Xerophloea* Germ. (*Mesodicus* Fieb., *Parapholis* Uhl.)

Specific characters, as recognized at present, are largely in the shape of the head and the size, but the taxonomy of the genus is not satisfactory. It is possible that there is some synonymy among the described species. The genus was revised by Lawson (1931).

*Xerophloea viridis* (Fab.) (*grisea* Germ., *virescens* Stål, *peltata* Uhl.) (Figs. 16, 519, 815).—Length: 6.0-7.5 mm. Usually light green, sometimes stramineous or light brownish with the pits darker brown; vertex occasionally with irregular, longitudinal, brown bands; pronotum often with brown markings near the anterior and posterior margins; veins and margins of forewings occasionally margined with brownish. The numerous circular pits that cover the body and forewings are distinctive. *Helochara communis* Fitch, which also has numerous pits, can be distinguished readily by the shape and structure of the head (Fig. 132), as well as by other characters.

Southern British Columbia, on hill grasslands, and grassland regions of Alberta, Saskatchewan and Manitoba; apparently widely distributed but not normally common. Host plants: grasses.

### Subfamily Dorycephalinae
### Tribe Dorycephalini
### Genus *Dorycephalus* Kouch.

Members of the genus are easily recognized by the unusually long, flattened head. Specific characters as recognized at present are largely in the shape of the head.

*Dorycephalus platyrhynchus* Osb. (Figs. 17, 520, 816).—Length: 7.5-13.0 mm. Yellowish-brown or greyish-brown; median area of the vertex and irregular areas on the pronotum often darker brown. In the female the abdomen exceeds the forewings considerably in length; in the male, which is smaller than the female, the forewings are longer than the abdomen.

Southern British Columbia, on hill grasslands, the grassland regions of Alberta, Saskatchewan, and Manitoba, and southern Ontario; widely distributed but local and not normally common. Host plant: wild rye.

### Subfamily Hecalinae
### Tribe Hecalini
### Key to genera of Hecalini

1. Spinelike setae on pygofer of male arranged in groups or tufts; straw-coloured or greenish insects, the male with black markings ..... 1. *Hecalus*
Spinelike setae on male pygofer randomly distributed, not arranged in groups or tufts; usually green insects without dark markings ..... 2. *Parabolocratus*

### Genus 1. *Hecalus* Stal (*Glossocratus* Fieb.)

*Hecalus lineatus* (Uhl.) (*fenestratus* Uhl.) (Figs. 18, 817).—Length 6.5 mm. Greenish-yellow with orange longitudinal bands on the head, thorax, and

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scutellum, and sometimes on the basal regions of the forewings; apical third of forewings paler, translucent green with the markings black; abdomen black. The form and markings are distinctive.

Southern Manitoba. Host plants: probably grasses.

### Genus 2. *Parabolocratus* Fieb.

The species often resemble one another closely on a basis of external characters, and the internal male genitalia must be examined for identifications. Females are usually difficult to name in the absence of associated males. The abdomen exceeds the forewings in length in the female but not in the male. The genus was revised by Shaw (1932), but a number of additional species have been described.

#### Key to species of *Parabolocratus*

1. Aedoeagus tapered in lateral view; apical processes of aedoeagus almost at right angles to shaft. Western ..... 3. *viridis*
   Aedoeagus truncate beyond bases of processes in lateral view; processes curved upward more or less in line with shaft ..... 2
2. Shaft of aedoeagus with numerous minute spines ..... 2. *major*
   Shaft of aedoeagus without such spines ..... 1. *continuus*

1. *Parabolocratus continuus* DeL. (*inflatus* DeL.) (Figs. 20, 521, 819).—Length: 5.0-7.5 mm. Green, the female sometimes faintly tinged with yellowish. The aedoeagus is distinctive.

British Columbia and Alberta, on hill grasslands, Yukon, Northwest Territories, and grassland areas of Alberta, Saskatchewan, and Manitoba. Host plants: grasses.

2. *Parabolocratus major* Osb. (Figs. 19, 818).—Length: 5.5-8.0 mm. Green or yellowish-green; forewings tinged with brown in the apical cells. The aedoeagus is distinctive.

Southern parts of British Columbia, Saskatchewan, Manitoba, Ontario, and Quebec; widely distributed on grasslands. Host plants: grasses.

3. *Parabolocratus viridis* Uhl. (*cyperaceae* Van D., *reverta* Van D., *terminus* DeL.) (Figs. 21, 820).—Length: 5.5-8.0 mm. Green, sometimes faintly tinged with yellowish. The aedoeagus is distinctive.

British Columbia, on hill grasslands, and grassland regions of Alberta, Saskatchewan, and Manitoba. Host plants: grasses.

## Subfamily Agalliinae
## Tribe Agalliini

Rather small, robust insects of rather distinctive form and markings. Some of the species are of economic significance. The subfamily was revised by Oman (1933).

#### Key to genera of Agalliini

1. Posterior margin of head sinuately curved behind eye ..... 1. *Agalliopsis*
   Posterior margin of head evenly curved, not sinuate behind eye ..... 2
2. Pronotum with a pair of large, rounded, black or dark-brown spots, its surface finely granulose ..... 2. *Agallia*
   Pronotum without such spots, its surface transversely rugulose ..... 3. *Aceratagallia*

### Genus 1. *Agalliopsis* Kirk.

#### Key to subgenera and species of *Agalliopsis*

1. Aedoeagus with a pair of lateral processes arising from base and extended posteriorly; posterior margin of female seventh sternum deeply and broadly excavated. Subgenus *Agalliopsis* ..... 2
   Aedoeagus without such processes; posterior margin of female seventh sternum not excavated. Subgenus *Agallaria* Oman ..... 1. *peneoculata*

2. Lateral basal process of aedoeagus long, with a pointed dorsolateral prominence at apical third; female seventh sternum broader and more deeply excavated. East of Rockies ..... 2. *novella*

Lateral basal process of aedoeagus shorter, with a pointed dorsolateral process almost at apex; female seventh sternum narrower and less deeply excavated. West of Rockies ..... 3. *novellina*

1. *Agalliopsis* (*Agallaria*) *peneoculata* Oman (Figs. 22, 522, 821).—Length: 4.5 mm. Dull brownish or fuscous-brown with the markings black. The internal male genitalia are distinctive.

Southern Ontario and southern Quebec. Host plant: possibly *Sambucus*.

2. *Agalliopsis* (*Agalliopsis*) *novella* (Say) (*nobilis* Forbes) (Figs. 23, 523, 822).—Length: 3.5-4.0 mm. Yellowish or yellowish-brown; spots of vertex and pronotum black or dark brown; pronotum more or less suffused with fuscous; forewings fuscous-brown between the veins. There is variation in the size of the dark spots and the intensity of the fuscous suffusions; in very dark specimens the pronotum is largely blackish whereas in very light specimens it is almost entirely pale. There is geographical, and some individual, variation in the shape of the process of the pygofer. This may be a complex of two or more species with different geographical distributions and host plants. The internal male genitalia and the female seventh sternum are distinctive. A somewhat distinctive feature is the pale claval veins, which contrast with the fuscous suffusion between them, but this feature is not constant.

Common and widely distributed in the southern parts of Alberta, Saskatchewan, Manitoba, Ontario, and Quebec, and found in New Brunswick. Host plants: alfalfa, clover, and probably other herbaceous plants. It is a vector of clover leaf-club virus.

3. *Agalliopsis* (*Agalliopsis*) *novellina* Oman (Figs. 24, 524, 823).—Length: 4.0-4.5 mm. Colour and markings as in *novella*, but the dark markings usually more intense. The variation in markings is as extensive as in that species. The internal male genitalia, notably the relatively short lateral processes of the aedoeagus, and the female seventh sternum are distinctive.

Southern British Columbia; widely distributed.

### Genus 2. *Agallia* Curt.

*Agallia quadripunctata* Prov. (*flaccida* Van D., *canadensis* Van D.) (Figs. 25, 525).—Length: 3.0-4.0 mm. Ochreous-brown with spots black and with fuscous suffusions on the pronotum and between the veins of the forewing. There is variation in the size of the dark markings and the intensity of the darker suffusions. The black spots on the pronotum, together with the shape of the head and the robust appearance, are distinctive. No males have been found in Canada.

Southern parts of British Columbia, Alberta, Saskatchewan, Manitoba, Ontario, and Quebec, and in New Brunswick; widely distributed and locally abundant. Normally found on the ground among the roots of grasses, sedges, and other plants, particularly in moist situations. The male is very rare everywhere and there is evidence that the species normally reproduces parthenogenetically.

### Genus 3. *Aceratagallia* Kirk.

Species of this genus can normally be named only by examination of the internal male genitalia, though in some instances the female seventh sternum shows reliable specific characters.

**Key to species of *Aceratagallia***

1. Style sinuately curved, with apical margin serrated ..... 2
   Style more nearly straight, with apical margin not serrated ..... 3
2. Apex of style bluntly pointed. East of Rockies ..... 1. *vulgaris*
   Apex of style sharply pointed. West of Rockies ..... 2. *californica*
3. Aedoeagus not V-shaped in lateral view, its shaft straight and evenly tapering between base and apical region ..... 3. *uhleri*
   Aedoeagus usually V-shaped in lateral view, its shaft either curved or not evenly tapering between base and apical region ..... 4
4. Apical region of aedoeagus strongly curved in lateral view; apical margin of style produced beyond base of beak; rather pale species with spots of vertex small and usually elongate ..... 4. *arida*
   Apical region of aedoeagus more nearly straight in lateral view; apical margin of style straight or nearly so; usually well-marked species with spots of vertex large and rounded ..... 5. *sanguinolenta*

1. *Aceratagallia vulgaris* Oman (Figs. 28, 528, 826).—Length: 2.5-3.0 mm. Ochreous with the spots of vertex black and the other dark markings of body and forewings dark brown. There is variation in the intensity of the dark markings. The style is distinctive.

Southern Ontario.

2. *Aceratagallia californica* (Bak.) (Figs. 26, 526, 824).—Length: 3.0-3.5 mm. Ochreous or brownish with the markings dark brown or black; veins of forewing dark brown on corium, pale on the clavus with dark brown suffusions between them. There is some variation in the intensity of the ground colour and of the dark markings. The style is distinctive.

Southern British Columbia, widely distributed and locally common up to 4,000 feet. Adults have been found hibernating under loose bark.

3. *Aceratagallia uhleri* (Van D.) (*enervis* Van. D., *venata* Van D.) (Figs. 29, 529, 827).—Length: 3.0-3.5 mm. Ochreous, with black markings on the head and scutellum and often with brown markings on the pronotum; veins of corium brown, and clavus often suffused with brownish between the veins. There is variation in intensity of the dark markings, but in general this is a pale insect as compared with *sanguinolenta*. The aedoeagus and style are distinctive.

Grassland regions of Saskatchewan and Manitoba, widely distributed but apparently rather local. Though it has been found on economic plants, such as carrot, bean, beet, turnip, potato, alfalfa, clover, and rape, it does not appear to be of economic significance.

4. *Aceratagallia arida* Oman (Figs. 27, 527, 825).—Length: 2.5-3.5 mm. Ochreous, with black markings on the vertex and scutellum and often with brown markings on the pronotum; corium with veins brown and clavus often suffused with brownish between the veins. There is some variation in the intensity of the dark markings and in size. In general, this is a paler insect than *sanguinolenta*. The relatively small, oval, oblique spots of the vertex are rather distinctive; *sanguinolenta* has larger spots and *uhleri* has small, round spots. The aedoeagus and style are distinctive.

Grassland regions of Alberta and Saskatchewan, widely distributed among alfalfa.

4. *Aceratagallia sanguinolenta* Prov. (*siccifolia* Uhl., *fuscoscripta* Oman) (Figs. 30, 31, 530, 828, 829).—Length: 2.5-3.25 mm. Light brownish-grey with black spots on the vertex and scutellum and fuscous-brown markings on the vertex and pronotum; corium with veins dark fuscous-brown and clavus with brownish-fuscous suffusions between the veins. There is much variation in the intensity of the dark markings; in some specimens the dark areas are almost black, in others

they are only weakly indicated. There is also some geographical variation in the male genitalia. Specimens from the West tend to have the apical region of the style more slender and the beak longer than specimens from the East, but this feature and differences in the degree of curvature of the aedoeagus and of the position of the spine on the shaft of the style, is not constant and all degrees of intergrading occur. The subspecies *fuscoscripta* replaces the typical subspecies west of the Rockies, and locally in the Prairie provinces. It tends to have the posterior margins of the male plates transverse, whereas in *sanguinolenta* the posterior margins slope downward from the mid-line (Fig. 829). Distinctive features of the species are the style and aedoeagus.

Alaska, British Columbia, Northwest Territories, Alberta, Saskatchewan, Manitoba, Ontario, Quebec, and Prince Edward Island, common and often abundant and probably occurring wherever alfalfa grows. It has been found in the Rockies at altitudes of up to 6,000 feet, and at sea-level in Prince Edward Island. Host plants: alfalfa, clover, China aster, and other herbaceous plants. There are two broods a year in Southern Ontario. It hibernates in the adult stage in debris.

## Subfamily Macropsinae
## Tribe Macropsini
### Key to genera of Macropsini

Anterior margin of pronotum rounded; striae of pronotum transverse ..... 1. *Oncopsis*
Anterior margin of pronotum angulate at middle; striae of pronotum converging anteriorly ..... 2. *Macropsis*

### Genus 1. *Oncopsis* Burm.

Species of this genus usually show much individual variation, as well as sexual dimorphism, in colour and markings. Because of this, and because structural specific characters are relatively slight, specimens often are difficult to name. The most reliable specific characters are in the shapes of the apical region of the style and of the female seventh sternum. The North American species were revised by Beirne (1951).

### Key to species of *Oncopsis*

1. Forewing with five apical and three anteapical cells ..... 2
   Forewing with four apical and two anteapical cells ..... 1. *verticis*
2. Males ..... 3
   Females ..... 8
3. Style distinctly broader at middle of shaft than near apex ..... 4
   Style not broader at middle of shaft than near apex ..... 5
4. Apical margin of style distinctly convex ..... 3. *coloradensis*
   Apical margin of style straight or concave ..... 2. *variabilis*
5. Style longer and more slender, the beak relatively short, pointed ..... 4. *nigrinasi*
   Style shorter and stouter, the beak usually blunt ..... 6
6. Dark brown or black; forewings with three pairs of hyaline, whitish spots ..... 5. *dithyris*
   Variously marked, but not as above ..... 7
7. Beak of style sharply pointed in lateral view ..... 6. *minor*
   Beak of style bluntly pointed in lateral view ..... 7. *sobrius*
8. Seventh sternum as long as or longer than wide, with a deep apical emargination to one-third of its length ..... 9
   Seventh sternum not longer than wide, or with only a shallow emargination ..... 10
9. Seventh sternum sharply pointed at either side of emargination. West of Rockies ..... 3. *coloradensis*
   Seventh sternum bluntly pointed at either side of emargination. East of Rockies ..... 2. *variabilis*
10. Seventh sternum short, with a wide emargination not bordered by projections ..... 4. *nigrinasi*
    Seventh sternum longer, with the emargination small and/or bordered at each side by a small projection ..... 11

11. Seventh sternum roughly triangular in general shape, the emargination narrow *6. minor*
Seventh sternum roughly quadrangular in general shape, the emargination wider ..... 12
12. Posterior margin of seventh sternum straight or almost straight, except at the emargination; forewing dark brown to black with hyaline, whitish areas *5. dithyris*
Posterior margin of seventh sternum sloping downward at each side of the emargination; forewing not as above ..... *7. sobrius*

1. *Oncopsis verticis* (Say) (Figs. 32, 531, 830).—Length: 4.5-5.0 mm. Brownish-yellow with the spots and other markings dark brown or blackish; forewings whitish-hyaline with the bands and suffusions black in the male and light brown, brown, or fuscous in the female. The wing neuration and the genitalic characters are distinctive.

Southern Ontario. Host plant: black walnut.

2. *Oncopsis variabilis* (Fitch) (*abietis* Fitch, *flavus* Walk., *flavescens* Prov., *clitellarius* Prov., *tumidifrons* DeL.) (Figs. 33-35, 532, 831).—Length: 3.5-5.0 mm. Male yellowish with dark brown or blackish markings; forewings hyaline with the veins broadly fuscous or blackish. There is variation in the intensity of the dark markings: in very dark specimens the pronotum, scutellum, and forewings, except along the commissure, are almost entirely dark fuscous or blackish. Female very variable. The chief colour forms are: entirely pale yellow; yellow with a broad brown or blackish band along the claval suture; head and thorax brown, forewing yellow, but often hyaline in the apical region, with a broad, brown band along the claval suture; as in the last but with the corium largely or wholly brown; and entirely brown except along the commissure. Distinctive features of the species are the apex of the style and the female seventh sternum.

Alberta, Saskatchewan, Manitoba, Ontario, Quebec, New Brunswick, and Nova Scotia, common and widely distributed throughout the southern and Boreal Forest regions. Host plants: birch and alder.

3. *Oncopsis coloradensis* (Bak.) (*californicus* Van D.) (Figs. 36-38, 533, 832).—Length: 4.0-5.0 mm. Male ochreous with the markings brownish; forewings hyaline, with the veins, especially the crossveins, fuscous. There is much variation: in dark specimens the head and pronotum are largely blackish, and in pale specimens they are almost wholly ochreous. The female is very variable. The chief colour forms are: entirely pale or dull yellow; yellow with a broad, brown band along the claval suture; head and thorax mahogany brown, a broad, brown band along the claval suture, and the crossveins sometimes brown; almost wholly dark brown except along the commissure. The style and the female seventh sternum are distinctive. An additional character that often is useful in separating this species from *variabilis* is that specimens, particularly males, often have two dark spots on the vertex; such spots are absent in *variabilis*.

Alaska, British Columbia, Yukon, and mountains of Alberta; widely distributed. Host plants: birch and alder.

4. *Oncopsis nigrinasi* (Fitch) (Figs. 39, 40, 534, 833).—Length: 4.5-5.0 mm. Male usually dirty fuscous with the commissure pale near base and beyond middle; sometimes dull ochreous with fuscous dots on head and thorax and ill-defined fuscous suffusions at the crossveins and the apical region of the forewing. Female greyish-ochreous or ochreous-fuscous, usually with a large, rounded, black spot on face, often with the scutellum dark brown or black, often with the forewings more or less suffused with fuscous but with the commissure pale near base and beyond middle. The genitalic characters are distinctive. The relatively dark scutellum, in specimens that have this character, and the alternating light and dark areas on the commissure tend to be distinctive.

Southern Ontario and southern Quebec, widely distributed but local. Host plant: blue beech.

5. *Oncopsis dithyris* Beir. (Figs. 41, 535, 834).—Length: 4.8-5.0 mm. Head yellow with the transverse bands black; thorax yellowish with numerous fuscous dots and, particularly in the male, fuscous or blackish suffusions; forewing dark brown to black with a whitish hyaline area at middle, a second such area in the region of the subapical cells, and a third at the apex of the clavus. This species exhibits less individual or sexual variation than do other species of the genus but the pale areas of the forewing are sometimes reduced. The colour and markings and the genitalic characters are distinctive.

Southern Ontario and southern Quebec, widely distributed but local. Host plant: birch.

6. *Oncopsis minor* (Fitch) (*fenestratus* Fitch, *ocellatus* Prov., *pruni* Prov., *dorsalis* Prov., *fitchi* Van D.) (Figs. 42, 536, 835).—Length: 4.0-5.0 mm. Male yellow with the transverse bands of the vertex black, the thorax heavily dotted and suffused with fuscous; forewing hyaline, variably suffused fuscous in the clavus, in the apical cells, and at the crossveins. In very dark specimens the pronotum is largely black and the forewing largely fuscous except along the commissure; in pale specimens the dark markings are greatly reduced. Female yellow or dull ochreous, with fuscous markings as in the male but usually less well-developed; forewings greyish-hyaline or ochreous-hyaline, with the apical cells, the crossveins, and the veins toward the base of the clavus fuscous. This species often cannot be distinguished from its allies, especially *sobrius*, on a basis of external characters. The apex of the style and the female seventh sternum are distinctive.

Alaska, British Columbia, Yukon, Northwest Territories, Alberta, Saskatchewan, Manitoba, Ontario, Quebec, New Brunswick, Nova Scotia, Prince Edward Island, and Labrador, widely distributed and often abundant, with a mainly Boreal distribution. It occurs northward to near the limits of the tree-line. Host plants: birch, alder, and, to a lesser degree, wild varieties of *Prunus*.

7. *Oncopsis sobrius* (Walk.) (*cognatus* Van D., ?*truncatus* Bak.) (Figs. 43, 537, 836).—Length: 4.5-5.5 mm. Male dull ochreous with the markings of the head black, the pronotum heavily dotted with fuscous, the scutellum brown or fuscous, and the forewing uniform brown, fuscous, or black except at the middle and near the apex of the commissure. Sometimes the forewings are greyish-ochreous with the veins heavily marked with fuscous. The female frequently is uniform brown; sometimes the pronotum and forewings are more or less suffused with fuscous, the body is ochreous marked with black as in the male, and the forewing greyish-hyaline with the veins and apical cells fuscous. This species can be recognized reliably only by the genitalic characters.

British Columbia, Alberta, Saskatchewan, Manitoba, Ontario, Quebec, New Brunswick, and Nova Scotia, widely distributed, but less common than *minor*, with a mainly Boreal distribution. Host plant: probably birch.

### Genus 2. *Macropsis* Lew. (*Bythoscopus* subgen. *Pediopsis* Burm.)

At present many of the species of this genus are impossible to identify reliably. It is possible that there is much unrecognized synonymy among the *Populus*- and *Salix*-feeding species. Except with the plum-feeding species, reliable specific characters have not been found in the genitalia of either sex; the genitalia of most species are similar to those of *M. fuscula* (Figs. 839). Specific characters used at present are almost entirely characters of colour and markings. As there is much individual variation, these characters usually are

not reliable. Structural differences between the species are slight, and not always constant. It is likely that species, or varieties, additional to those mentioned below occur in Canada. The genus was revised by Breakey (1932) and the economic species by Beirne (1954).

**Key to species and species groups of *Macropsis***

1. Host plants, *Prunus* spp. ..... 2
   Host plants not *Prunus* spp. ..... 3
2. Aedoeagus long, slender, strongly curved, forked at apex, its apical region not expanded; forewing with one or no whitish areas, in female often with veins paler than ground colour ..... 1. *insignis*
   Aedoeagus shorter, stouter, and less strongly curved, with apical region flattened and flaringly expanded laterally; forewing usually with three whitish areas 2. *trimaculata*
3. Host plants, *Rubus* spp.; face with three pairs of black spots; pronotum with two pairs of large, black spots near anterior margin; hind tibia with black spot at base 3. *fuscula*
   Host plants not *Rubus* spp.; head and pronotum not marked as above ..... 4
4. Host plant, honey locust ..... 6. *fumipennis*
   Host plant not honey locust ..... 5
5. Host plant, elm; hind tibia usually with black spot at base ..... 4. *glandacea*
   Host plant not elm; hind tibia usually without black spot at base ..... 6
6. Hind tibia with black spot at base; anterior margin of pronotum acutely angled; host plants, *Salix* and *Populus* spp. ..... 5. *virescens*
   Hind tibia without black spot at base; anterior margin of pronotum not acutely angled 7
7. Female pale green without dark markings; male greenish with forewings amber, without dark markings; host plants: *Salix* and *Populus* spp. ..... 7. *viridis*
   Not green with dark markings on forewings ..... 8
8. Host plants, *Populus* spp. ..... 8. *basalis* group
   Host plants, *Salix* spp. ..... 9. *ferruginoides* group

1. *Macropsis insignis* (Van D.) (Figs. 45, 838).—Length: 4.0-4.5 mm. Greyish-fuscous or brownish-fuscous with the basal triangles of scutellum dark brown and the forewing usually with a whitish spot at the first crossveins; female usually with the veins paler than the ground-colour. Newly-emerged specimens are pruinose. The aedoeagus is distinctive.

Southern Ontario, common and widely distributed. Host plants: *Prunus* spp. There is a possibility that the species may be implicated in the spread of the virus diseases that cause the symptoms known as peach yellows and little peach.

2. *Macropsis trimaculata* (Fitch), the plum leafhopper, cicadelle du prunier, (Figs. 44, 837).—Length: 4.25-5.0 mm. Light greyish-fuscous to blackish-fuscous with the basal triangles of scutellum dark brown and the forewing with three pellucid, whitish areas. Newly-emerged specimens are feebly pruinose. There is variation in the general colour, and in the size of the whitish spots of the forewing. One or more of the latter often are reduced or absent. The aedoeagus is distinctive. In some specimens the lateral process of the apical region of the aedoeagus are broken off.

Southern Ontario, southern Quebec, and Nova Scotia. Host plants: *Prunus* spp. The species is a vector of the virus that causes the symptoms known as peach yellows and little peach.

3. *Macropsis fuscula* (Zett.) (*rubi* Boh., *tibialis* Scott) (Figs. 46, 839).—Length: 4.0-5.0 mm. Dull ochreous to light fuscous, with the markings of the head, pronotum, and scutellum black and the veins of the forewings fuscous or blackish. Distinctive features are the black spot at the base of each hind tibia and the facial markings, which are as follows: a rounded or comma-shaped spot beneath each ocellus, a smaller spot beneath each of these, a large, elongate pair lower down and nearer to the mid-line, and the sides of the clypeus black. There

is variation in the sizes of these black markings, as well as in the general colour of the insect.

Southwestern British Columbia. First found in North America on Lulu Island, B.C., in 1952, and has since spread and become locally abundant. It probably was artifically introduced from Europe. Host plants: loganberry, raspberry, and probably other forms of *Rubus*. It is often abundant and is regarded as a pest species on these plants. In Europe the species is a vector of the virus disease known as rubus stunt.

4. *Macropsis glandacea* Fieb. (*ulmi* Scott) (Figs. 49, 50).—Length: 4.0-4.5 mm. Female pale green or pale yellowish-green. Male light brownish-ochreous, often with the head and thorax paler. There is usually a black spot at the base of each hind tibia. The host plant and the black-spotted hind tibiae are distinctive.

Southern Ontario, locally common. Host plant: elm. A European species that probably was artificially introduced into North America. All introduced European species of *Macropsis* have the black-spotted hind tibia, whereas the native species lack these spots.

5. *Macropsis virescens* (Gmel.) (*graminea* Fab., *latifasciata* Break.) (Figs. 51, 52).—Length: 4.0-5.0 mm. Pale yellowish-green, usually without dark markings except for a black spot at the base of each hind tibia. The var. *graminea* (Fig. 51) has a round, black spot at the apex of the vertex. The var. *latifasciata* (Fig. 52) has a pair of longitudinal, dark brown or black stripes from the head to the apex of the clavus. Both varieties occur occasionally with the typical form. The combination of the green colour and the black-spotted hind tibiae is distinctive. The pronotum, and the vertex, are more acutely angulate in front than in other species of the genus.

Southern Ontario and southern Quebec, widely distributed and locally common. A European species first found in North America in 1915 and now widely distributed in the East. Host plants: *Populus* and *Salix* spp.

6. *Macropsis fumipennis* (Gill. & Bak.) (*crocea* Osb. & Ball, *gleditschiae* Osb. & Ball) (Figs. 47, 48).—Length: 4.5-5.0 mm. Green, suffused with blackish-fuscous on the pronotum and scutellum; forewing fuscous, becoming paler apically and with the costal region and the commissure green. There is variation in the intensity of the fuscous colouration; some specimens are wholly green or yellowish-green.

Southern Ontario, common. Host plant: honey locust. The insects occur mainly on the leaf stalks and smaller branches.

7. *Macropsis viridis* (Fitch) (Figs. 58, 59).—Length: 4.5-5.5 mm. Female green or yellowish-green, occasionally fulvous-brown. Male green or yellowish-green with the forewings usually tinged with brownish. This is the only green species on *Populus* or *Salix* that lacks a black spot at the base of each hind tibia.

Southern parts of British Columbia, Alberta, Saskatchewan, Ontario, and Quebec, and in Nova Scotia. Host plants: *Populus* and *Salix* spp.

8. *Macropsis basalis* group.—Host plants of members of this group are species of *Populus*. There is a possibility that some may also be associated with *Salix* and that some of the members of the *ferruginoides* group, whose known host plants are species of *Salix*, may also be associated with species of *Populus*. Specific limits in and between the two groups are ill-defined. Many specimens are intermediate in characters between forms that have been given specific status, and others, particularly if they lack host plant data, could be any of several such forms. Many specimens, however, agree with specific descriptions. These are

as follows. *M. basalis* (Van D.) (Figs. 55, 56).—Length: 5.0-5.5 mm. Female ferruginous or ferruginous-ochreous, usually with a broad, dark brown band, that is usually darker than the thorax, bordering the scutellum. In pale specimens there are often ill-defined, dark brown transverse bands at the middle and near the apex of forewing; these specimens intergrade with forms of *canadensis*, *bifasciata*, and *sordida*. Male either similar to the female, or sordid ferruginous or brownish either without distinct dark markings or with the forewing darker at base. British Columbia, Alberta, Saskatchewan, Ontario, and Quebec, apparently with a mainly Boreal distribution. Host plant: quaking aspen. *M. bifasciata* (Van D.) (Fig. 57).—Length: 5.0-6.0 mm. Usually reddish-ochreous with the basal triangles of the scutellum brown and the forewing ochreous-greyish with irregular, fuscous transverse bands at the middle and near the apex. Fresh specimens are tinged with greenish. Southern parts of Alberta, Ontario, and Quebec. Host plant: quaking aspen. *M. nigricans* Van D. (Fig. 54).—Length: 5.0-5.5 mm. Ochreous with the markings of the forewing dark brown or blackish. Southern Manitoba. Host plant: cottonwood. *M. osborni* Break. (Fig. 53).—Length: 5.0-6.0 mm. Greenish-yellow with the basal half of the clavus dark brown. Southern Alberta. Host plant: cottonwood. It is quite likely that some of these forms, together with some forms of the group that have not been found in Canada, may be conspecific.

9. *Macropsis ferruginoides* group.—Host plants of members of this group are species of *Salix*. Specific limits are ill-defined (see remarks under *M. basalis* group, above). The following forms found in Canada agree with specific descriptions. *M. ferruginoides* (Van D.) (Fig. 60).—Length: 5.5-6.0 mm. Ochreous, tinged red; forewings suffused with fulvous-brown from base, the colour becoming fainter beyond the middle and the costal region not darkened. Southern Alberta. *M. canadensis* (Van D.) (*flavescens* Van D.) (Fig. 62).—Length: 5.0-5.5 mm. Pale yellowish or greenish-ochreous, sometimes ochreous-fulvous, with the transverse bands of the forewing brown. Southern parts of British Columbia, Alberta, Saskatchewan, Manitoba, and Ontario. *M. suturalis* (Osb. & Ball) (Fig. 61).—Length: 5.0-5.5 mm. Light ochreous-fulvous, tinged greenish, or light, dull greenish; basal triangles of scutellum usually blackish-brown; forewing with a broad, blackish-brown band from base to apex bordering the commissure and including the entire clavus. Southern Saskatchewan and southern Ontario. *M. rufocephala* Osb. (*scutellatus* Osb.).—Length: 5.0-5.5 mm. pale yellowish-green with the head, pronotum, and anterior two-thirds of the scutellum reddish-brown. Southern Manitoba. *M. sordida* (Van D.) (Figs. 63, 64, 538).—Length: 4.5-5.0 mm. Brownish or, more usually, fuscous, and sometimes blackish; forewing usually irregularly mottled blackish-fuscous, sometimes entirely blackish-fuscous, and occasionally with irregular, ill-defined, transverse fuscous bands at middle and near apex. Alaska, British Columbia, Yukon, Northwest Territories, Alberta, Saskatchewan, Manitoba, Ontario, and Quebec. Rather common and with a mainly northerly distribution. It is the most common form of the genus in the Subarctic. It is quite likely that some of the forms of this group, together with some that have not been found in Canada, may be conspecific.

### Subfamily Idiocerinae
### Tribe Idiocerini
### Genus *Idiocerus* Lewis

Members of this genus can be recognized by the shape of the head. On a basis of existing literature, reliable specific identifications are difficult and sometimes impossible. There is much individual and local variation in colour

and markings, and in the size and in the form of the dorsal arm of the aedoeagus. Many forms that have been accorded specific status intergrade with one another in morphological characters. This is especially true of the species whose host plants are species of *Salix* and *Populus*. The names of many such forms have been tentatively reduced to synonymy here, pending clarification of their status that may be revealed largely by host plant studies and breeding experiments. Type material of the Ball and Parker species has been examined. Specific characters in the genus are primarily in structures of the internal male genitalia, in particular of the style and of the apical region of the aedoeagus. At time of writing the taxonomy of the North American species is under study by P. Ludwig.

**Key to species of *Idiocerus***

1. Vertex with a pair of rounded, black spots or with a single median black spot ..... 6
   Vertex without such black spots ..... 2
2. Gonopore at apex of aedoeagus; forewings sometimes without dark markings ... 2. *populi*
   Gonopore not at apex of aedoeagus, usually near bases of lateral processes; forewings always with dark markings ..... 3
3. Aedoeagus with processes arising from ventral surface at least a third of the length of shaft from apex, the shaft not narrowed immediately beyond bases of processes in lateral view; style with short, stout spines at apex ..... 10. *decimusquartus*
   Aedoeagus with processes arising laterally near apex and with apical region of shaft tapering from near bases of processes in lateral view; style either with long, stout spines or without stout spines at apex ..... 4
4. Main longitudinal veins of corium distinctly banded with white before apex of clavus; style without stout spines at apex, distinctly narrowed before middle and expanded beyond middle ..... 9. *distinguendus*
   Main longitudinal veins of corium not banded with white before apex of clavus; style with a pair of long, stout spines at apex, not narrowed before and expanded beyond middle ..... 5
5. Forewing darkest along commissure; general colour yellowish-brown or reddish-brown; veins not, or not distinctly, banded with white beyond apex of clavus; processes of aedoeagus short ..... 7. *amabilis*
   Forewing not darkest along commissure; general colour ochreous or brownish, usually with a greyish tinge; veins distinctly banded with white beyond apex of clavus; processes of aedoeagus long ..... 8. *lachrymalis*
6. Vertex with a single, large, median black spot ..... 5. *productus*
   Vertex with a pair of rounded, dark spots ..... 7
7. Pale yellowish or yellowish-green, usually with a brown or reddish-brown band along the commissure, otherwise without dark markings except for the two spots of the vertex; aedoeagus broad in lateral view, with the processes arising from shortly beyond middle of shaft ..... 1. *snowi*
   Not marked as above, but with other or additional dark markings; processes of aedoeagus either arising from near apex of shaft or absent ..... 8
8. Veins of forewing not banded with white ..... 11
   Veins of forewing banded with white, at least in the commissural region and near the apices of the anteapical cells ..... 9
9. Main longitudinal veins of corium banded with white before apex of clavus ..... 10
   Main longitudinal veins of corium not banded with white before apex of clavus 8. *lachrymalis*
10. Style narrowed before and expanded beyond middle, without long, stout spines at apex 9. *distinguendus*
    Style not as above, with a pair of long, stout spines at apex ..... 6. *alternatus*
11. Forewing with a broad, yellow band on clavus from base to near apex that is separated from scutellum and commissure by a broad, black or dark brown band; pronotum and scutellum largely uniform black or brown ..... 13. *provancheri*
    Not coloured and marked as above ..... 12
12. Forewing with a yellowish-white area at costa in region of subapical cells, costa otherwise largely blackish or dark brown; aedoeagus without processes ..... 12. *fitchi*
    Forewing not as above; aedoeagus with lateral subapical processes ..... 13

13. Aedoeagus broad in lateral view, with a pair of short, stout teeth on dorsal surface of shaft beyond middle and with the processes relatively long ..... 3. *brunneus*
Aedoeagus more slender in lateral view, without teeth on shaft, and with the processes shorter ..... 14
14. Aedoeagus in lateral view with shaft parallel-sided to bases of processes, then tapered to apex; spots of vertex large; pronotum with two, large, black spots near anterior margin; host plants, *Crataegus* spp. ..... 11. *crataegi*
Aedoeagus in lateral view with shaft tapering from base to apex; spots of vertex smaller; pronotum with several, small, black spots near anterior margin; host plants, *Salix* spp. ..... 4. *musteus*

1. *Idiocerus snowi* Gill. & Bak. (*cauterus* Ball & Pkr.) (Figs. 71, 542, 844).—Length: 5.5-6.0 mm. Pale green or yellowish-green with the spots of the vertex black; forewing hyaline greenish or yellowish-green, usually with a brown, dark brown, reddish-brown, or reddish band along the commissure, and usually with the apical cells smoky. Occasionally the commissural band is faint or absent and occasionally the basal triangles of the scutellum are dark brown or black. The markings and the aedoeagus and style are distinctive.

Southern British Columbia, grassland regions of Alberta, Saskatchewan, and Manitoba, apparently widely distributed and common, and southern Ontario. Host plants: *Salix* spp.

2. *Idiocerus populi* (L.) (*pallidus* Fitch, *obsoletus* Walk., *suturalis* Fitch, *duzeei* Prov., *perplexus* Gill. & Bak., *nervatus* Van. D.) (Figs. 65-67, 539, 840).—Length: 4.5-6.5 mm. The chief forms of this polytypic species, which intergrade in characters of size, colour, and markings and have apparently identical genitalic characters, are as follows. Var. *pallidus* (*obsoletus*): (Fig. 65) pale green, greenish-ochreous, or pale yellowish, without dark markings. Var. *nervatus*: relatively small in size, length 4.5-5.0 mm., and light green with semihyaline forewing through which the dark veins of the hindwings are visible. Var. *duzeei* (*perplexus*): relatively large in size, length 5.5-6.5 mm., body yellowish or yellowish-green, and forewing yellow or golden yellow with the apical region often smoky. Var. *suturalis* (Fig. 66) yellowish or pale yellowish-green with the basal angles of the scutellum, a broad band along the commissure from the scutellum to the apex of the clavus, and the veins of the apical region brown, and the appendix smoky. Var. *lunaris* Ball: (Fig. 67) posterior half of pronotum brownish; scutellum dark brown; forewing with a broad, dark brown band, interrupted at middle by a crescent-shaped pale area, occupying most of the clavus and extending posteriorly onto the corium, the veins of the apical region dark brown, and the appendix smoky. Var. *vagus* Ball: basal triangles of scutellum dark brown; forewing hyaline with the abdomen visible through them, the apical veins brown, and the appendix sometimes smoky. Var. *continuus* Ball: a broad, dark brown or blackish band from pronotum to apex of clavus, appendix smoky, and veins of apical region of forewing dark brown. The chief character that distinguishes this species is the location of the gonopore at the apex of the aedoeagus, instead of some distance below the apex. The various varieties intergrade in characters, often in the one population.

British Columbia, Northwest Territories, Alberta, Saskatchewan, Manitoba, Ontario, Quebec, and New Brunswick. Widely distributed and locally abundant in the southern and Boreal regions. The vars. *vagus* and *continuus* appear to be mainly confined to the mountains of the West. In general, the var. *suturalis* occurs more frequently than other varieties in northern and mountain areas; it is the form that occurs in Northwest Territories, and it has been found in the Rockies at altitudes of up to 7,000 feet. Var. *nervatus* may be most frequent in dry situations. Host plants: of *pallidus* and *suturalis*, *Salix* spp. and aspen, of *nervatus*, *Salix* spp., and of *duzeei*, cottonwood.

3. *Idiocerus brunneus* Osb. & Ball (*ramentosus* Uhl., *inscriptus* Van D.) (Figs. 73, 544).—Length: 5.0-5.5 mm. Light cinnamon brown; vertex with two black spots, each surrounded by a yellow ring; veins of forewing margined with minute brown dots. Occasionally the pronotum is darkened and the basal triangles of the scutellum are black, and there is some variation in the general colour from more reddish-brown to more greyish-brown. The ovipositor is relatively short. The aedoeagus is distinctive.

Southern parts of British Columbia, Alberta, and Saskatchewan, apparently locally common. Host plants: *Salix* spp.

4. *Idiocerus musteus* Ball. (Figs. 72, 543, 845).—Length: 5.0-5.5 mm. Vertex yellow, with the spots black and with a brownish area at either side of the mid line; pronotum light brown, its anterior region yellow with a few black spots; scutellum yellow with the markings brown or black; forewing hyaline light cinnamon-brown to light greyish-brown, with a distinct coppery sheen, the veins minutely dotted with darker brown or fuscous. This species resembles *brunneus* somewhat but the aedoeagus is distinctive. Moreover, *brunneus* usually lacks the black markings on the pronotum and scutellum that commonly are present in this species.

Southern British Columbia, apparently widely distributed and locally common, up to 4,500 feet. Host plants: *Salix* spp.

5. *Idiocerus productus* Gill. & Bak. (Figs. 70, 843).—Length: 6.0 mm. Head yellow with a large, dark brown or blackish spot at the middle of the anterior margin of the vertex; pronotum black with a few, irregular, yellow spots and with the posterior margin broadly yellow; scutellum black, yellow at the margins and with two yellow spots on the disc; forewing semihyaline, tinged fuscous, the veins fuscous except at the middle and beyond the apex of the clavus. The colour and markings are distinctive.

Alaska, Yukon, Northwest Territories, and mountains of British Columbia and Alberta. Host plants: probably *Salix* spp.

6. *Idiocerus alternatus* Fitch (*femoratus* Ball, *downesi* Ball & Pkr., *coconius* Ball & Pkr., *chicanus* Ball & Pkr.) (Figs. 80, 81, 549, 851).—Length: 5.0-5.5 mm. Vertex and thorax yellowish with the markings black and brownish, the pronotum usually whitish on the mid line; forewings hyaline ochreous or fuscous with the veins brown or fuscous, the main longitudinal veins banded white and a whitish area on the commissure at middle of clavus. There is much variation. The general colour varies from pale brownish-ochreous to dark fuscous; specimens from northern areas tend to be more fuscous and those from dry, southern areas more ochreous. There is variation in the thickness of the middle femur, which is remarkably stout in some specimens (var. *femoratus*). The varieties intergrade. The evenly-curved style with the pair of long, slender setae at its apex and the white-banded veins of the forewings are distinctive. This species differs from *I. lachrymalis* in having the main longitudinal veins of the corium white-banded before the apex of the clavus, in tending to be smaller in size, and in not having the scutellum usually contrastingly paler than the forewings.

Alaska, British Columbia, Yukon, Northwest Territories, Alberta, Saskatchewan, Manitoba, Ontario, Quebec, New Brunswick, and Labrador, common and widely distributed. It occurs northward to the limits of the tree-line and has been found on mountains up to 3,200 feet. Host plants: *Salix* spp.

7. *Idiocerus amabilis* Ball (Figs. 68, 540, 841).—Length: 6.0 mm. Vertex yellow with light reddish-brown areas at either side of the mid line; pronotum yellow anteriorly and along the margins, otherwise light reddish-brown or brown

with the median line and a rounded patch at either side of it whitish; scutellum yellowish with the markings reddish-brown, brown, or black; forewing hyaline brownish with a broad, dark brown band, interrupted at middle by a rounded whitish spot, along the commissure, a paler transverse band before the apical cells, and the veins brown. This species resembles superficially *I. populi* var. *lunaris* but can be distinguished readily by characters of the male genitalia.

Southwestern British Columbia, apparently widely distributed. Host plants: *Salix* spp.

8. *Idiocerus lachrymalis* Fitch (*hebetus* DeL. & Hersh.) (Figs. 82, 550, 852).—Length 5.5-7.5 mm. Vertex yellowish with two black spots that usually are confluent with a black, transverse facial band; pronotum ochreous with irregular, small, black or dark brown spots near anterior margin; scutellum ochreous with the markings brown, dark brown, or black; forewing whitish-hyaline, sometimes suffused with fuscous at base, at middle, and at apex, the veins strongly marked with fuscous, but white at middle of clavus and, usually, before the apical cells. This species is very variable in size, markings, and general colour. The ochreous head and thorax that contrast with the darker, more greyish, general hue of the forewings, and the transverse black band at the margin of the vertex tend to be distinctive.

Alaska, British Columbia, Northwest Territories, Alberta, Saskatchewan, Manitoba, Ontario, and Quebec, widely distributed in the southern and Boreal forest regions. It appears to be most frequent in hill and mountain districts and has been found in several localities at 7,000 feet or higher. Host plants: aspen and probably *Salix* spp.

9. *Idiocerus distinguendus* Kirsch. (*lucidus* Kirsch., ?*bohemani* Kirsch., *cognatus* Fieb., ?*moniliferae* Osb. & Ball, *bovinus* Ball & Pkr., *nogalinus* Ball & Pkr.) (Figs. 77-79, 548, 850).—Length: 5.5-6.0 mm. Yellowish, the forewing with the apical region brown, a brownish transverse band at apex of clavus, and the veins dark brown in these darkened areas. Or, head and thorax yellowish with the markings reddish-brown and black; forewing hyaline-brownish with a faint coppery sheen, usually with a rounded whitish area on the commissure at middle of clavus, and the veins whitish except at the apical region and in line with the apex of the clavus. These two forms intergrade. The most distinctive feature is the form of the style. The dark spots of the vertex are relatively small and are sometimes absent.

Southern British Columbia and southern Ontario. Host plants: *Populus* spp.

10. *Idiocerus decimusquartus* Schr. (*scurrus* Germ., *crenatus* Germ., *germari* Fieb., *gemmisimulans* Leonard & Crosby) (Figs. 69, 541, 842.—Length: 6.0-7.0 mm. Vertex and thorax ochreous with the markings blackish or dark brown; forewing hyaline greyish-brown with the markings, when present, dark brown, and with the longitudinal veins white or yellowish at base and middle of clavus and near base and beyond middle of corium. The dark markings of the forewings are frequently reduced or absent. The internal male genitalia are distinctive.

Southern British Columbia and southern Ontario, probably introduced from Europe. Host plants: *Populus* spp.

11. *Idiocerus crataegi* Van. D. (Figs. 74, 847).—Length: 5.0-5.5 mm. Vertex yellow with the spots black; pronotum yellow with two black blotches near anterior margin and the disc suffused with brown; scutellum yellow with the basal triangles black and the median area brownish or black; forewing semi-hyaline ochreous, tinged with brownish, with the commissure yellow and the veins dark brown. Distinctive features are the yellow commissure contrasting with the remainder of the wing, and the internal male genitalia.

Southern Saskatchewan and southern Ontario. Host plants: *Crataegus* spp.

12. *Idiocerus fitchi* Van D. (*maculipennis* Fitch) (Figs. 75, 546, 848).—Length: 5.5 mm. Head yellow with the spots black; pronotum and scutellum yellow with the markings black and reddish-brown; forewings brownish-yellow with the veins brown and with a rectangular yellow patch, bordered anteriorly and posteriorly with brown, in the costal region before the apical cells. The colour and markings and the internal male genitalia are distinctive.

Southern Ontario and southern Quebec, evidently rather local. Host plants: probably *Salix*, *Crataegus*, and *Populus* spp.

13. *Idiocerus provancheri* Van D. (Figs. 76, 547, 849).—Length: 4.5-5.5 mm. Head yellow with the spots black; pronotum cinnamon brown to black, usually with a median, pale area anteriorly, usually darker bordering the scutellum and along the costal region, with a large, bright-yellow patch occupying most of the basal two-thirds of the clavus, except at the scutellum and commissure, and with a large, rectangular, whitish area on the costa before the apical cells. The colour and markings and the male genitalia are distinctive.

Southern regions of British Columbia, Alberta, Manitoba, Ontario, Quebec, and New Brunswick, widely distributed but apparently rather local. Host plants: apple, plum, and *Crataegus* sp.

### Subfamily Iassinae

### Key to tribes of Iassinae

Ocelli on vertex ..... Gyponini
Ocelli on margin of vertex ..... Iassini

### Tribe Gyponini

Large, robust insects, usually green or brown and usually with few or no definite dark markings. The majority of the species can be named reliably only by characters of the internal male genitalia. The tribe was revised by DeLong (1942).

### Key to genera of Gyponini

1. Surface of vertex coarsely and irregularly rugose; margin of gena strongly sinuated ..... 1. *Prairiana*
   Surface of vertex striated; margin of gena not or only feebly sinuated ..... 2
2. Striae of vertex longitudinal; anterior margin of head usually distinctly carinate ..... 3
   Striae of vertex transverse; anterior margin of head not carinate ..... 5. *Ponana*
3. Vertex and pronotum with numerous dark spots ..... 2. *Negosiana*
   Vertex and pronotum without such spots ..... 4
4. Forewing with at least the apical portion reticulately veined, and with appendix much reduced so that its greatest width is distinctly less than width of base of first apical cell ..... 3. *Gyponana*
   Forewing not reticulately veined and with appendix not reduced but equal or greater in width than width of base of first apical cell ..... 4. *Gypona*

### Genus 1. *Prairiana* Ball

*Prairiana cinerea* (Uhl.) (Figs. 83, 551, 853).—Length: 5.5-7.5 mm. Female light brown, male more fuscous brown; head and thorax with numerous dark brown or fuscous spots; forewing with numerous dark brown or fuscous spots bordering the veins. The spots and the genitalic characters are distinctive.

Grassland regions of Alberta and Saskatchewan, locally common.

### Genus 2. *Negosiana* Oman

*Negosiana negotiosa* (Gibs.) (Figs. 84, 552).—Length: 7.5 mm. Ochreous-brown, the head and pronotum with numerous, small, dark brown spots. The genitalic characters are distinctive.

Southern Manitoba.

### Genus 3. *Gyponana* Ball

Large, green or yellowish species that resemble one another very closely in external characters. They can be named reliably only by examination of the internal male genitalia. The host plants are not definitely known but probably are species of trees or shrubs.

#### Key to species of *Gyponana*

1. Apical region of style large, broad, blade-like, with tip sharply pointed ..... 7
   Apical region of style not blade-like, less broad, with tip bluntly rounded ..... 2
2. Aedoeagal process at least half as long as shaft ..... 4
   Aedoeagal process one-quarter as long as shaft, or less ..... 3
3. Aedoeagal processes very short and almost straight ..... *5. orientala*
   Aedoeagal processes longer, strongly curved ..... *6. octolineata*
4. Shaft of aedoeagus in ventral view with a short projection at either side near apex ..... *1. tubera*
   Aedoeagus without such projections ..... 5
5. Aedoeagal processes as long as shaft ..... *4. vincula*
   Aedoeagal processes not more than two-thirds as long as shaft ..... 6
6. Shaft of aedoeagus relatively broad in ventral view, with the processes extending outward and then curving downward; apical region of style relatively long, slightly curved downward ..... *3. extenda*
   Shaft of aedoeagus more slender, with the processes extending downward; apical region of style shorter, straight ..... *2. flavilineata*
7. Aedoeagal processes minutely serrated on their outer margins ..... *10. serrata*
   Aedoeagal processes not serrated ..... 8
8. Pronotum with eight, faint, orange, longitudinal bands. Mainly Eastern ..... 9
   Pronotum without such bands. British Columbia ..... *7. basta*
9. Aedoeagal processes straight, more than half as long as shaft ..... *9. salsa*
   Aedoeagal processes curved, about one-fourth as long as shaft ..... *8. arcta*

1. *Gyponana tubera* DeL. (Fig. 856).—Length 9.0-10.5 mm. Pale greenish-ochreous; forewing sometimes almost whitish, particularly toward the apex; pronotum usually with eight, faint, orange, longitudinal bands that frequently extend onto the vertex and pronotum. The aedoeagus is distinctive. The species is closely related to, and may be conspecific with, *flavilineata*.

Southern Ontario.

2. *Gyponana flavilineata* (Fitch) (*pruinosa* Spang.) (Figs. 90, 553, 854).—Length: 9.0-11.0 mm. Pale greenish or greenish-ochreous, the forewing almost whitish, particularly toward the apex; pronotum usually with eight, faint, orange, longitudinal bands that frequently extend onto the vertex and scutellum. The internal male genitalia are distinctive.

Southern parts of British Columbia, Alberta, Saskatchewan, Ontario, and Quebec, widely distributed.

3. *Gyponana extenda* DeL. (Fig. 855).—Length: 9.0-11.0 mm. Pale greenish or pale greenish-ochreous; pronotum often with eight, faint, orange, longitudinal bands that sometimes extend onto the vertex and scutellum. It is possible that this is conspecific with *flavilineata*: the genitalic differences are slight and there is some individual variation.

Southern Ontario and southern Quebec.

4. *Gyponana vincula* DeL. (Fig. 858).—Length: 8.0-9.0 mm. Light green; pronotum usually with eight, faint, orange, longitudinal bands that frequently extend onto the vertex and scutellum. The aedoeagus and style are distinctive.

Southern Saskatchewan.

5. *Gyponana orientala* DeL. (Figs. 88, 863).—Length: 9.0 mm. Ochreous, with indications of orange longitudinal bands on the pronotum. The aedoeagal processes are distinctive.

Southern Ontario.

6. *Gyponana octolineata* (Say) (*geminata* Osb.) (Figs. 89, 857).—Length: 7.5-9.5 mm. Pale ochreous-greenish; pronotum usually with eight, faint, orange, longitudinal bands that frequently extend onto the vertex and scutellum. The relatively short, curved aedoeagal processes are distinctive. The var. *serpenta* DeL. has the apical portion of the style slightly curved downward.

Southern parts of British Columbia, Alberta, Saskatchewan, Manitoba, and Ontario, and in New Brunswick and Prince Edward Island; apparently rather common.

7. *Gyponana hasta* DeL. (Figs. 87, 862).—Length: 7.5-10.0 mm. Pale greenish-ochreous or pale ochreous, the forewing often becoming whitish toward apex. Unlike other Canadian species, this lacks orange longitudinal bands on the pronotum. The aedoeagal processes and the style are distinctive.

Southern British Columbia, apparently the most common species of the genus in that region. It is a vector of California aster yellows.

8. *Gyponana arcta* DeL. (Figs. 86, 861).—Length: 7.5-9.5 mm. Green or ochreous-green, the forewing often becoming whitish toward apex; pronotum with eight, faint, orange, longitudinal bands that frequently extend onto the vertex and scutellum. The aedoeagal processes and the style are distinctive.

Southern Ontario and southern Quebec, apparently widely distributed.

9. *Gyponana salsa* DeL. (Figs. 85, 860).—Length: 8.0-9.5 mm. Light ochreous-green; pronotum usually with eight, faint, orange, longitudinal bands that frequently extend onto the vertex and scutellum. This species is closely related to *serrata*, of which it may be a variety.

Alberta, Ontario, and Quebec, in the Boreal Forest regions.

10. *Gyponana serrata* DeL. (Figs. 91, 859).—Length: 7.5-10.0 mm. Light ochreous-green; pronotum usually with eight, faint, orange, longitudinal bands that frequently extend onto the vertex and scutellum. Rarely, the forewings and the posterior half of the pronotum are purplish. The minutely serrated aedoeagal processes are distinctive.

British Columbia, Saskatchewan, Manitoba, Ontario, Quebec, and Nova Scotia, in the southern and Boreal Forest regions.

### Genus 4. *Gypona* Germ.

*Gypona melanota* Spang. (*dorsalis* Spang., *bipunctata* Woodworth, *nigra* Woodworth) (Figs. 92, 554, 864).—Length: 8.5-10.0 mm. Male usually with the vertex black; pronotum black with the side margins yellow; scutellum black with yellow at the basal corners; forewing yellowish, fuscous, or black, except at the costal region which is yellowish. Sometimes the vertex and pronotum are partly black and partly brown, or partly brown and partly yellowish-green, and sometimes the male is wholly green or yellowish-green. Female green or yellowish-green, without dark markings. The female is more distinctly green than are species of *Gyponana*. The aedoeagus and style are distinctive.

Grassland regions of Alberta, Saskatchewan, and Manitoba, widely distributed and locally common.

### Genus 5. *Ponana* Ball

#### Key to species of *Ponana*

1. Vertex and pronotum heavily marked with small, red dots ..... 1. *scarlatina*
   Vertex and pronotum not with red dots ..... 2
2. Forewing brown or yellowish-brown with numerous dark brown spots, the costal region not distinctly paler than remainder of wing ..... 3
   Forewing not with numerous dark brown spots, with costal region dull yellowish-green, distinctly paler than remainder of wing ..... 3. *pectoralis*

3. Pronotum with two or three pairs of black spots near anterior margin ..... 2. *quadralabra*
Pronotum without such spots ..... 4. *rubida*

1. *Ponana scarlatina* (Fitch) (*irrorella* Spang., *spadix* DeL., *rodora* Ball) (Figs. 93, 865).—Length: 8.0-9.0 mm. Brown or yellowish-brown, the dorsal surface closely covered with small, red spots; vertex sometimes with a dark spot at each ocellus; veins of forewing margined with red. The colour and markings and the internal male genitalia are distinctive.

Southern Ontario, and Nova Scotia.

2. *Ponana quadralabra* DeL. (Figs. 94, 866).—Length: 7.5-8.0 mm. Yellowish-brown; pronotum with three pairs of black spots near anterior margin; forewing with irregular dark spots, usually linear, mainly in the commissural region, in the brachial cell, and at the crossveins. The colour and markings and the internal male genitalia are distinctive.

Southern Ontario.

3. *Ponana pectoralis* (Spang.) (*hullensis* Prov., *albimarginata* Woodworth, *bimaculata* Woodworth, *woodworthi* Van D., *colon* Van D.) (Figs. 96, 556, 868).—Length: 8.0-10.0 mm. Yellowish-brown; scutellum usually brown; forewing with a broad, dark brown band from base of clavus to apex of wing, and the crossveins margined with dark brown. The colour and markings and the internal male genitalia are distinctive.

Southern parts of Manitoba, Ontario, and Quebec; widely distributed.

4. *Ponana rubida* DeL. (Figs. 95, 555).—Length: 9.0-10.0 mm. Brownish-yellow; forewing with dark, linear spots between the veins and with the apical crossveins usually brown. The spots vary considerably in number and size. The colour and markings and the internal male genitalia are distinctive.

Southern parts of Manitoba, Ontario, and Quebec; widely distributed.

### Tribe Iassini

### Genus *Strangania* Stal (*Garganopsis* Fowl.)

Members of this genus are distinctive in form. Identification of species is largely on genitalic characters. The species vary in size and colour, and to some extent in genitalic characters. The genus was revised by Beamer and Lawson (1945).

#### Key to species of *Strangania*

1. General colour pale green without dark markings other than small spots in the appendix and apical cells. Eastern ..... 2
Pale green or green with the scutellum darkened. Western ..... 1. *rufoscutellata*
2. Posterior margin of female seventh sternum produced at middle; apex of style curved in a semicircle ..... 2. *alabamensis*
Posterior margin of female seventh sternum almost straight, not produced at middle; apical region of style not so strongly curved ..... 3. *apicalis*

1. *Stangania rufoscutellata* (Bak.) (Figs. 97, 557, 869).—Length: 4.5-5.0 mm. Green, with the scutellum and often the adjacent parts of the forewing, brown, reddish-brown, or brownish-ochreous. Sometimes the scutellum is not darkened and sometimes the pronotum is brown. The darkened scutellum and the genitalic characters are distinctive.

British Columbia, on hill grasslands, and grassland regions of Alberta, Saskatchewan, and Manitoba; widely distributed and locally common.

2. *Strangania alabamensis* (Bak.) (Figs. 98, 559, 870).—Length: 4.5 mm. Pale ochreous-greenish-, with small, black spots in the apical region of the forewing. The genitalic characters are distinctive.

Southern Ontario.

3. *Strangania apicalis* (Osb. & Ball) (Figs. 99, 558, 871).—Length: 5.0 mm.

Pale yellowish-brown with small, black spots in the apical region of the forewing. The genitalic characters are distinctive.

Southern Ontario. Host plant: honey locust.

**Subfamily Penthimiinae**
**Tribe Penthimiini**
**Genus *Penthimia* Germ.**

*Penthimia americana* Fitch (*vicaria* Walk., *picta* Prov.) (Figs. 100, 560, 872).—Length: 5.5-6.0 mm. Dark reddish-brown, usually more or less suffused with fuscous or blackish and sometimes largely fuscous or blackish; scutellum usually with yellow or light brown areas at either end of the transverse impression and at the apex; forewing with the apical cells and the posterior parts of the subapical cells hyaline ochreous, with the veins dark and with dark suffusions in the central areas of these cells. The robust form of the insect is distinctive.

Manitoba, Ontario, Quebec, and Nova Scotia; widely distributed in the southern and Boreal Forest regions. Host plants: probably some woody plants.

**Subfamily Koebeliinae**
**Tribe Koebeliini**
**Genus *Koebelia* Bak.**

*Koebelia californica* Bak. (Figs. 101, 561, 873).—Length: 5.5-7.0 mm. The abdomen is longer than the wings in the female, but shorter in the male. Ochreous; vertex, pronotum, and scutellum more or less suffused with brown or dark brown, and closely and finely irrorated with brown, dark brown, or fuscous; forewing whitish, with raised black spots bordering the veins and margins, suffused with brownish or dark brown and closely and finely irrorated with dark brown or fuscous, the darkened areas forming indefinite transverse bands before the middle of the clavus and at its apex and at the bases of the apical cells. As indicated above, there is variation in the general colour. The male genitalia are distinctive.

Southwestern British Columbia. It has been found on pine.

**Subfamily Coelidiinae**
**Tribe Coelidiini**
**Genus *Coelidia* Germ. (*Daridna* Walk., *Deridna* Van D.)**

*Coelidia olitoria* (Say) (*subbifasciata* Say, *fuscipennis* Spang., *semifasciata* Uhl.) (Figs. 102, 562, 874).—Length: 6.5-7.5 mm. Head yellow; pronotum yellow, usually more or less suffused with dark brown, particularly in the central area, and sometimes entirely black; scutellum usually brown with darker brown or black markings, but sometimes wholly black; forewing brown, dark brown, or blackish, the veins darker, the female, and sometimes the male, with pale transverse bands before the middle of the clavus and at its apex; a fulgorid-like insect. The form of the head and the general external appearance are distinctive.

Southern Ontario, widely distributed in woodlands. Host plants: ash and probably other woody plants.

**Subfamily Aphrodinae**
**Tribe Aphrodini**
**Genus *Aphrodes* Curt. (*Acucephalus* Germ., *Pholetaera* Zett.)**

There is much variation in colour and markings in species of this genus, but the internal male genitalia show reliable specific characters. There is sometimes sexual dimorphism in colour and markings. The species normally occur on the surface of the ground, among grass roots and under litter, and probably

feed on grasses. Because of their habits they are susceptible to artificial introductions with plants. All the known North American species also inhabit Europe, and it is possible that some or all of them may be artificial introductions. The North American species were discussed by Beirne (1954).

**Key to species of *Aphrodes***

1. Aedoeagus with a single pair of processes and with its apical region toothed at the sides ..... 4. *agrestis*
   Aedoeagus with two pairs of processes and with its apical region not toothed ..... 2
2. Aedoeagus with both pairs of processes arising from about middle of shaft; larger species, 5.5-8.0 mm. long ..... 1. *costata*
   Aedoeagus with at least one pair of processes arising from apical region of shaft; smaller species, 4.5 mm. or less in length ..... 3
3. Aedoeagus with both pairs of processes arising from apical region of shaft 3. *fuscofasciata*
   Aedoeagus with one pair of processes arising near middle of shaft and the second pair arising near apex ..... 2. *flavostrigata*

1. *Aphrodes costata* (Panz.) (*nervosa* Schr., *rustica* Fab., *striata* Fab., *striatella* Fab., *transversa* Fab., *bicincta* Curt., *cardui* Curt., *fasciata* Curt., *obscura* Curt., *pallida* Curt., *rugosa* Curt., *sparsa* Curt., *unicolor* Curt., *pulverulenta* Curt., *adusta* Hardy) (Figs. 103, 563, 875).—Length: 5.5-8.0 mm. Male ochreous or brownish in general colour; vertex yellowish, usually brown or black anteriorly and with brownish or blackish markings at the posterior margin near the eyes; pronotum yellowish with broad, brown, transverse bands at the anterior and posterior margins; scutellum yellowish with brown or dark brown irrorations; forewing some shade of brown, usually light brown, with the veins, particularly the outer claval vein, usually yellow or ochreous. Female ochreous or yellowish with the body and forewings irrorated and irregularly spotted with fuscous. There is extensive variation in the extent and intensity of the dark markings. Some females are entirely pale and others almost uniformly dark, but the majority of specimens have the spots and irrorations. The size of this species, the transversely banded pronotum of the male, and the aedoeagus are distinctive.

Southern British Columbia, southern Saskatchewan, and the southern and Boreal Forest regions of Ontario and Quebec, widely distributed and locally common. It appears to be most frequent in open wooded areas, among the roots of herbaceous plants and under ground debris.

2. *Aphrodes flavostrigata* (Don.) (*rivularis* Germ., ?*placida* Prov., *albifrons* Ball) (Figs. 104-106, 564, 876).—Length: 3.0-4.5 mm. Male ochreous to dark brown, usually light brownish-ochreous, often becoming darker toward apex of forewing; vertex often with darker brown or blackish markings; forewing with interrupted, whitish, transverse bands before middle of clavus and at its apex, and with apex whitish. There is much variation in the ground colour and in the size and intensity of the dark markings. Female ochreous, closely and heavily irrorated with dark brown throughout but usually with ochreous areas at the commissure and in the apical region of the forewing, particularly at the margins. The general colour varies from ochreous to dark fuscous and there is much variation in the intensity of the irrorations. The aedoeagus is distinctive.

Southern British Columbia, southern and Boreal Forest regions of Ontario and Quebec, and Nova Scotia, New Brunswick, and Prince Edward Island. It is found on the ground among roots of herbaceous plants and under litter.

3. *Aphrodes fuscofasciata* (Goeze) (*transversalis* Geoff., *bistriata* Gmel., *serratulae* Fab., *brunneobifasciata* Sign.) (Figs. 107, 108, 565, 877).—Length: 3.5-4.5 mm. General colour of male light ochreous; vertex often suffused or mottled with brown or fuscous anteriorly; scutellum often suffused or marked

with brown or fuscous; forewing with a dark brown transverse band, sometimes incomplete, beyond middle of costa and another such band before apex. There is much variation in the size and intensity of the dark markings. Female ochreous, sometimes irrorated with dark brown, particularly on the vertex and in the apical region of the forewing. The aedoeagus is distinctive.

Widely distributed in southern British Columbia and southern Ontario.

4. *Aphrodes agrestis* (Fall.) (*mixta* Say) (Figs. 109, 566, 878.—Length: 5.0-6.5 mm. Both sexes dull brown or reddish-brown, closely and finely irrorated with dark brown or fuscous. There is much variation in the general colour and the extent of the irrorations. The aedoeagus is distinctive.

Widely distributed in the southern and Boreal Forest regions of Manitoba, Ontario, and Quebec.

### Subfamily Xestocephalinae
### Tribe Xestocephalini
### Genus *Xestocephalus* Van D.

Small, robust insects that occur mainly on the ground among roots of herbaceous plants and in litter. Oman (1949) suggested that the nymphs may live in the soil, possibly in ants' nests. The North American species were revised by Peters (1933). Specific distinctions are largely in characters of the colour and markings. It is possible that there is some conspecificity among the species as they are at present recognized. Specimens from southern Ontario that agree with the descriptions of *nigrifrons* Osb. and *brunneus* Van D. may be varieties of species discussed below.

#### Key to species of *Xestocephalus*

| | | |
|---|---|---|
| 1. | Pronotum with a broad, yellow, transverse band | 1. *coronatus* |
| | Pronotum not as above | 2 |
| 2. | Vertex uniform brown, without distinct markings | 2. *superbus* |
| | Vertex pale, with distinct dark markings | 3. *pulicarius* |

1. *Xestocephalus coronatus* Osb. & Ball (Figs. 111, 881).—Length: 2.5-3.0 mm. Vertex and thorax bright yellow and black; forewing hyaline whitish with the markings fuscous-brown and the claval veins whitish at the commissure. The markings are distinctive.

Southern British Columbia and southern Ontario.

2. *Xestocephalus superbus* (Prov.) (*fulvocapitatus* Van D.) (Figs. 112, 567, 879).—Length: 2.5-3.0 mm. Head and thorax light brown or brown; forewings hyaline whitish with a brownish tinge, and with the markings brown or dark brown. The uniform colour of the vertex and pronotum distinguish this species from the following.

Widely distributed in the southern parts of British Columbia, Ontario and Quebec.

3. *Xestocephalus pulicarius* Van D. (? *similis* Peters) (Figs. 110, 880).—Length: 2.5-3.5 mm. Vertex and thorax ochreous with the markings brown; forewings hyaline with the markings brown or dark brown.

Southern parts of British Columbia, Ontario, and Quebec.

### Subfamily Neocoelidiinae
### Tribe Neocoelidiini

Members of this tribe apparently have been collected in Canada only rarely. The North American species were revised by DeLong (1953). It is possible that species additional to those listed below occur in the West.

### Key to genera of Neocoelidiini

Small, robust insects, less than 4.0 mm. in length; forewings not or barely longer than abdomen; vertex not with median black spot at apex; forewing not darkened along commissure ..... *Neocoelidia*

Larger insects, 5.0 mm. or more in length; vertex with a median black spot at apex; forewing longer than abdomen and usually darkened along commissure ..... *Stenocoelidia*

### Genus *Neocoelidia* Gill. & Bak.

*Neocoelidia tumidifrons* Gill. & Bak. (? *vittipennis* DeL., ? *orientalis* DeL.) (Figs. 113, 882).—Length: 3.5 mm. Dull yellowish without dark markings, but sometimes with the claval vein and the costal region of the forewing tinged with brown. The aedoeagus is distinctive. There is variation in the form of the aedoeagus, notably in whether or not its ventral arm is simple or forked.

Southern Saskatchewan and southern Quebec.

### Genus *Stenocoelidia* DeL.

*Stenocoelidia lineata* (Bak.) (Figs. 114, 568, 883).—Length: 6.0 mm. Pale yellowish with a black spot at apex of vertex and usually with an indefinite brownish or fuscous band along the commissure of the forewings. The markings and the aedoeagus are distinctive.

Southern British Columbia.

## Subfamily Tettigellinae

### Key to tribes of Tettigellinae

1. Forewings narrow, not covering lateral margins of abdomen; face with a distinct ledge above each antennal pit ..... Proconiini
   Forewings covering or nearly covering lateral margins of abdomen; face without a distinct ledge above each antennal pit ..... 2
2. Vertex and clypeus each with a median carina ..... Evacanthini
   Vertex and clypeus without such carinae ..... 3
3. Ocelli nearer to disc of vertex than to posterior margin ..... Tettigellini
   Ocelli nearer to posterior margin of vertex than to disc ..... Errhomenellini

### Tribe Proconiini

### Genus *Cuerna* Mel.

Large, robust insects, largely black or black and red in colour. Specific characters are primarily in the form of the aedoeagus. The nymphs feed on herbaceous plants.

### Key to species of *Cuerna*

1. Forewings entirely black ..... 3. *septentrionalis*
   Forewings partly red ..... 2
2. Anterior processes of aedoeagus curved at right angles, posterior processes about half length of anterior; larger species, 7.0-9.0 mm. in length ..... 1. *striata*
   Anterior processes of aedoeagus weakly curved or sinuate, posterior processes about as long as anterior; smaller species, 5.5-7.0 mm. in length ..... 2. *alpina*

1. *Cuerna striata* (Walk.) (Figs. 115, 569, 884).—Length: 7.0-9.0 mm. Head and thorax black, with numerous, small, yellow markings; forewing hyaline ochreous or brownish with the central areas of the cells, except in the costal region, irrorated with brown or blackish, the outer anteapical and at least the outer claval cell red, and the veins black. There is variation in the extent of the dark areas in the cells and in the extent and intensity of the red colour. The aedoeagus is distinctive.

This species has a mainly Boreal distribution and is apparently more frequent in the West than in the East. It is widely distributed, both on the mountains and the lowlands, and has been found northward almost to the tree-line. British Columbia, Yukon, Alberta, Saskatchewan, Manitoba, Ontario, Quebec and Nova Scotia.

2. *Cuerna alpina* Oman & Beam. (Figs. 116, 885).—Length: 5.5-7.0 mm. Head and thorax black, with the markings yellow; forewing yellowish with the costal region, and often the outer claval cell, red, the veins black, and linear black markings in the central areas of the cells except in the costal region. This is a smaller insect than its relatives, and more yellowish-tinged in general colour. The aedoeagus is distinctive.

Grassland regions of Alberta and Saskatchewan, widely distributed.

3. *Cuerna septentrionalis* (Walk.) (*limbata* Say) (Figs. 117, 886).—Length: 7.0-8.0 mm. Wholly black apart from a few yellow spots on the vertex and pronotum. The colour and the aedoeagus are distinctive.

Grassland regions of Alberta and Manitoba, widely distributed.

### Tribe Tettigellini

### Key to genera of Tettigellini

| | | |
|---|---|---|
| 1. | Central anteapical cell of forewing open basally | 2 |
| | Central anteapical cell of forewing closed basally | 3 |
| 2. | Third apical cell of forewing about twice as wide at apex as at base | 1. *Tylozygus* |
| | Third apical cell of forewing only slightly wider at apex as at base | 2. *Plesiommata* |
| 3. | Forewing reticulately veined beyond apex of clavus | 3. *Draeculacephala* |
| | Forewing not reticulately veined | 4 |
| 4. | Forewing closely covered with minute pits | 4. *Helochara* |
| | Forewing without such pits | 5 |
| 5. | Anterior margin of head distinctly angulate | 5. *Graphocephala* |
| | Anterior margin of head rounded | 6 |
| 6. | Aedoeagus symmetrical | 6. *Neokolla* |
| | Aedoeagus asymmetrical | 7. *Keonolla* |

#### Genus 1. *Tylozygus* Fieb.

*Tylozygus bifidus* (Say) (*nigrolineatus* H.-S., *tenellus* Walk.) (Figs. 118, 570, 887).—Length: 5.0-6.0 mm. Vertex yellow with the markings black; pronotum green, with two black transverse bands, the first bordered behind a yellow band, the second by a greenish or greenish-yellow band; scutellum greenish-yellow; forewing yellowish-green with the veins black and the appendix and apical region fuscous. The colour and markings are distinctive.

Widely distributed in southern Ontario and southern Quebec. Host plants: probably grasses.

#### Genus 2. *Plesiommata* Prov.

*Plesiommata tripunctata* (Fitch) (*biundularia* Prov.) (Figs. 119, 571, 888).—Length: 5.0 mm. Stramineous, tinged with brownish; spots of vertex black; pronotum with the transverse bands and the margins brown; median band of scutellum brown; veins of forewing brown. The colour and markings are distinctive.

Southern Quebec.

#### Genus 3. *Draeculacephala Ball*

Members of this genus are distinctive and rather uniform in external appearance. They are rather large insects, with the vertex long and sharply pointed, the vertex and thorax largely yellowish or greenish-yellow and the forewings green. Though the markings and the shape of the vertex sometimes are of specific value, the internal male genitalia must be examined for reliable identifications. The females often are difficult to name reliably in the absence of associated males. There is sexual dimorphism in the shape, and often in the markings, of the vertex. The host plants are grasses or sedges and the species are found in grasslands and swampy situations.

**Key to species of *Draeculacephala***

1. Ventral plate of aedoeagus long and narrow in ventral view; vertex relatively long with the dark markings faint ..... 2
   Ventral plate of aedoeagus rounded or lobed in ventral view; vertex often relatively shorter, usually with the dark markings well-defined ..... 3
2. Ventral plate of aedoeagus bilobed at apex in ventral view ..... 1. *antica*
   Ventral plate of aedoeagus rounded at apex in ventral view ..... 2. *mollipes*
3. Ventral plate of aedoeagus not rounded in ventral view ..... 4
   Ventral plate of aedoeagus rounded in ventral view ..... 5
4. Ventral plate of aedoeagus trilobed at apex in ventral view; male without a heavy dark triangle in middle of vertex but with heavy dark markings beside eyes and at apex of vertex ..... 6. *novaeboracensis*
   Ventral plate of aedoeagus roughly triangular in ventral view; male usually with a heavy black triangle at middle of vertex, and with the dark markings beside eyes and at apex of vertex less heavy ..... 5. *angulifera*
5. Apical half of antenna usually distinctly flattened and expanded, black; ventral plate of aedoeagus wider than long in ventral view; markings of vertex more distinct ..... 4. *crassicornis*
   Antenna tapering, filamentous; ventral plate of aedoeagus longer than wide in ventral view; markings of vertex more weak ..... 3. *producta*

1. *Draeculacephala antica* (Walk.) (*constricta* Dav. & DeL.) (Figs. 120, 121, 572, 889).—Length: 6.0-8.0 mm. Head and thorax yellowish or greenish-yellow with markings of the vertex dark brown and the posterior two-thirds of the pronotum dark green; forewing dark green with the veins lighter green and the costal region whitish or yellowish. A rather small species with a long, faintly-marked vertex. The margins of the vertex usually are straight whereas in *mollipes*, which this species closely resembles on a basis of external characters, the margins tend to be slightly convex. The aedoeagus is distinctive.

Southern and northern British Columbia, the southern parts of Saskatchewan, Ontario, and Quebec, and Prince Edward Island. Widely distributed, and apparently more frequent in the East than in the West.

2. *Draeculacephala mollipes* (Say) (*innotata* Walk., *viridis* Prov.) (Figs. 122, 123, 890).—Length: 6.0-8.0 mm. A rather small species with a long, faintly-marked vertex. Colour and markings as in *antica*. The aedoeagus is distinctive.

Widely distributed in southern Ontario and southern Quebec.

3. *Draeculacephala producta* (Walk.) (*acuta* Walk.) (Figs. 126, 127, 573, 891).—Length: 7.0-10.0 mm. Head and thorax yellow or greenish-yellow with the markings of the vertex dark brown and the posterior two-thirds of the pronotum dark green; forewing dark green with the veins green and the costal region whitish. Like *antica* and *mollipes*, this species has dark markings of the vertex slender and often faint, but it is larger than those species, with the vertex slightly but distinctly relatively shorter. The aedoeagus is distinctive.

Southern Ontario and southern Quebec. Widely distributed and locally common in moist situations.

4. *Draeculacephala crassicornis* Van D. (Figs. 128, 129, 574, 892).—Length: 6.0-9.0 mm. Head and thorax yellowish with the markings of the vertex dark brown or black and the posterior two-thirds of the pronotum dark green; forewing dark green with the veins green and the costal region yellowish-white. A distinctive feature is the distinctly flattened and expanded antenna. However, this character is not always reliable, as some specimens have the antenna filamentous or nearly so. The aedoeagus is distinctive.

This species has a Boreal and mountain distribution. Alaska, widely distributed in British Columbia both on the mountains and the lowlands, Yukon,

Northwest Territories, mountains of Alberta, and the Boreal regions of Manitoba, Ontario, and Quebec.

5. *Draeculacephala angulifera* (Walk.) (*manitobiana* Ball) (Figs. 124, 125, 575, 893).—Length: 7.0-9.0 mm. Head and thorax yellow with the markings of the vertex black and the posterior two-thirds of the pronotum dark green; forewing dark green with the veins green and the costal region yellowish-white. A rather distinctive feature is the black triangle in the middle of the vertex of the male, though this sometimes is absent in weakly-marked specimens. This character, and the fact that the black marks near the eyes and at the apex of the vertex tend to be less well-developed, often serves to distinguish the species from *novaeboracensis*, which it resembles. The aedoeagus is distinctive.

Widely distributed; most frequent in northern and mountain areas and rare in southern areas. Alaska, central British Columbia, widely distributed in Yukon and Northwest Territories, hill and mountain districts of Alberta, widely distributed in Saskatchewan, Manitoba, Ontario, and Quebec, and found in New Brunswick, Nova Scotia, and Labrador.

6. *Draeculacephala novaeboracensis* (Fitch) (*prasina* Walk.) (Figs. 130, 131, 576, 894).—Length: 7.0-9.0 mm. Head and thorax yellow with the markings of the vertex black and the posterior two-thirds of the pronotum dark green; forewing dark green with the veins green and the costal region greenish-yellow. A relatively short-headed species with heavy black markings on the vertex beside the eyes and at the apex. The aedoeagus is distinctive.

Widely distributed and often common, especially in moist situations. It has a more southerly distribution than *angulifera*. British Columbia, Yukon, Alberta, Saskatchewan, Manitoba, Ontario, Quebec, New Brunswick, and Nova Scotia.

### Genus 4. *Helochara* Fitch

*Helochara communis* Fitch (*herbida* Walk., *delta* Oman) (Figs. 132, 577, 895).—Length: 4.5-5.5 mm. Green or yellowish-green; vertex with brown arcs anteriorly and often suffused with brownish; pronotum usually partly suffused with dull, dark green; forewing suffused dull, dark green in the apical region of the clavus, in the brachial cell, and in the subapical cells, and with the apical cells and the appendix whitish or brownish. There is much individual and environmental variation in the shape of the head and in the colour. Frequently the pronotum and forewings are almost wholly dark, dull green, sometimes they are wholly yellowish-green, and sometimes the general colour is brownish-green. The var. *delta* is a large form with the head relatively strongly produced. A distinctive feature of the species is the large number of minute pits that cover the dorsal surface.

A very common and widely-distributed species that occurs in marshy and other moist situations of all kinds throughout the southern and Boreal regions of Canada. It has been found in British Columbia (up to 2,500 feet), Alberta, Saskatchewan, Manitoba, Ontario, Quebec, New Brunswick, Nova Scotia, and Prince Edward Island. It hibernates as an adult and emerges very early from hibernation, often before the snow has melted. The var. *delta* is a vector of Pierce's disease of grape. Host plants: sedges and probably some grasses.

### Genus 5. *Graphocephala* Van D.

*Graphocephala coccinea* (Forst.) (*quadrivittata* Say, *picta* Walk., *teliformis* Walk., *idonea* Fowl., *confluenta* Olsen, *punctata* Olsen, *sambuci* Olsen) (Figs. 136, 578, 896).—Length: 7.5-9.0 mm. Vertex yellow, heavily margined with black anteriorly; pronotum yellow anteriorly and laterally, rich green posteriorly and in middle, and usually with a dark red area at each side of the median

green area; scutellum orange-yellow; forewing with a dark green band bordering the scutellum and extending along the commissure to beyond the middle of the clavus, a broad, dark red band outside this extending from base to apex of clavus, a broad, dark green band along the claval suture, a broad, dark red band outside this extending to apex of wing, the appendix fuscous, and the remainder of the wing dark green. There is variation in the shades of the reds and greens and to the extent to which one colour is developed in relation to the other on the pronotum and forewings. It is possible that this strikingly-marked species is in fact a complex of two or more species with different host plant associations.

Southwestern British Columbia (probably artificially introduced from the East), southern Manitoba, widely distributed in the southern and Boreal regions of Ontario and Quebec, and in New Brunswick, Nova Scotia, and Prince Edward Island. On trees and shrubs, especially in moist situations. Host plants: choke cherry and probably other woody plants.

### Genus 6. *Neokolla* Mel.

*Neokolla hieroglyphica* (Say) (*gothica* Sign., *similis* Woodw.) (Figs. 133, 579, 897).—Length: 5.0-6.0 mm. Head and thorax yellow, pink, or reddish with the markings dark brown or black and with the pronotum usually weakly suffused fuscous, ochreous, or whitish except near the anterior and lateral margins; forewing the same general colour as the head but more dull, weakly suffused with brownish or ochreous, and with the markings fuscous or blackish. There is much variation in the general colour, as indicated above, and the dark markings vary considerably in size and intensity. Despite the variation, the external appearance of the species is distinctive.

Common and widely distributed in the southern parts of British Columbia, Alberta, Saskatchewan, Manitoba, Ontario, and Quebec, and found also in New Brunswick, Nova Scotia, and Prince Edward Island. Host plants: woody plants.

### Genus 7. *Keonolla* Oman

*Keonolla confluens* (Uhl.) (Figs. 134, 580, 898).—Length: 6.0-7.0 mm. Vertex yellow with the markings black; pronotum yellow or yellow and light reddish, unusually darker toward the anterior and lateral margins, with the markings black; scutellum yellow with the markings black; forewing dark brown or fuscous, sometimes reddish-brown, irrorated throughout with dull whitish or dull ochreous. Though the general colour and the extent of the dark markings vary, the external appearance is distinctive.

Southern British Columbia, common and widely distributed and sometimes locally very abundant, and southern Alberta. It is a vector of Pierce's disease of grape and of Western X- disease of cherry and peach. Host plants: *Salix* spp.

### Tribe Evacanthini

### Genus *Evacanthus* LePel. & Serv.

*Evacanthus acuminatus* (Fab.) (*interstinctus* Fall., *germari* Curt., *orbitalis* Fitch) (Figs. 135, 581, 899).—Length: 4.5-6.0 mm. In the female the abdomen exceeds the forewing in length. Ochreous yellow with the markings black. There is much variation in the extent of the dark markings: some specimens are wholly yellow except for a pair of black spots near the posterior margin of the vertex; others are largely black except for the costal region and the commissure of the forewing and a few small areas on the head. The carinae on the vertex are distinctive.

A widely distributed but local species with a mainly mountain and Boreal distribution. It has been found in localities in Alaska, British Columbia, Alberta, Saskatchewan, Ontario, Quebec, and New Brunswick.

### Tribe Errhomenellini

It is possible that species additional to that discussed below may inhabit in British Columbia. Because of this, the internal male genitalia should be examined for reliable identification. This tribe was revised by Oman (1938).

### Genus *Errhomus* Oman

*Errhomus montanus* (Bak.) (Figs. 137, 138, 582, 900).—Length: (male) 5.5-6.0 mm. and (female) 7.25-7.75 mm. Male macropterous, female brachypterous. Pale, dull yellowish with the dark markings brownish or fuscous. The male tends to be more heavily dark-marked than the female and is sometimes largely fuscous except on the veins of the forewing. The external appearance and the genitalic characters are distinctive.

Southern British Columbia (up to 2,500 feet).

### Subfamily Typhlocybinae

Small, fragile insects, sometimes brightly coloured. The great majority of the species can be named reliably only by examination of the internal male genitalia. Females usually are impossible to name reliably in the absence of associated males. The species often are very restricted in their host plants and habitats but often are abundant where they occur. Probably because of their small size, members of this subfamily are lesser known than those of any other large group. It is probable that many species additional to those discussed below will be found in Canada or Alaska; some species that are still undescribed are known to occur in Canada. Most discoveries are likely to be made in the genera *Empoasca* and *Erythroneura*.

### Key to tribes of Typhlocybinae

1. Forewing with an appendix (Fig. 902) ..... Alebrini
   Forewing without an appendix ..... 2
2. Hindwing with submarginal vein present and extending along costa to beyond apex of vein R + M (Fig. 902) ..... Dikraneurini
   Hindwing with submarginal vein either present, when it does not extend beyond apex of vein R or R + M (Fig. 904), or absent (Figs. 905, 906) ..... 3
3. Hindwing with vein IV present (Fig. 904); usually pale and not strongly marked insects ..... Typhlocybini
   Hindwing with vein IV absent (Fig. 906); usually brightly-coloured and strongly marked insects ..... Erythroneurini

### Tribe Alebrini

### Genus *Alebra* Fieb.

Members of this genus feed on woody plants. At time of writing the tribe is being revised by D. A. Young.

*Alebra albostriella* (Fall.) (*elegantula* Zett., *discicollis* H.-S., *fasciata* Curt., *fulveola* H.-S., *wahlbergi* Boh., *exima* Hardy, *aurea* Walsh., *binotata* Walsh., *pallidula* Walsh, *viridis* Rey, *fumida* Gill., *flavocephala* Kupka, *bicincta* DeL., *eburnea* DeL., *rubrafrons* DeL., *agresta* McA., *insignita* McA., *scopa* McA., *tincta* McA., *diluta* Rib., *dufouri* Rib., *brunnea* Rib., *pallescens* Rib.) (Figs. 139, 140, 583, 907).—Length: 3.5-4.0 mm. Yellowish-white, bright golden-yellow, orange, brownish, or fuscous brown, without definite dark markings. There is extensive colour variation. It is possible that this is a complex of two or more species. The appendix of the forewing and the genitalic characters are distinctive.

Southern British Columbia and widely distributed in southern Ontario. Host plants: hawthorn, basswood, ironwood, beech, sumac, and probably other woody plants.

### Tribe Dikraneurini

Species of this tribe tend to be less fragile than those of most other tribes of Typhlocybinae. They are usually without well-defined dark or bright-coloured markings, and tend to be some shade of brown, streaked with darker on or between the veins of the forewing.

#### Key to genera of Dikraneurini

1. Hindwing with vannal veins separate at their apices (Fig. 902) ..... 2
   Hindwing with the vannal veins fused throughout their length Fig. (903) ..... 4. *Dikrella*
2. Male plates forceps-like or caliper-like ..... 1. *Dicranoneura*
   Male plates not forceps-like or caliper-like ..... 3
3. Style with distinct preapical lobe ..... 3. *Dicraneura*
   Style without distinct preapical lobe ..... 2. *Notus*

### Genus 1. *Dicranoneura* Dougl. (*Forcipata* DeL. & Cald.)

Identification of species is primarily on characters of the male genitalia. The shape of the female seventh sternum sometimes is of specific value, but that sternum is liable to be damaged: it consists of a narrow basal region from which arises a large, rounded plate that commonly is broken off. There is some sexual dimorphism in that the head is longer and more distinctly pointed in the female than in the male. The host plants probably are grasses. The genus was revised by DeLong and Caldwell (1936).

#### Key to species of *Dicranoneura*

1. Male plate strongly curved, with a single projection at apex ..... 1. *calipera*
   Male plate weakly curved, with two or more projections at apical region ..... 2
2. Shaft of aedoeagus evenly curved upward and tapered to apex ..... 2. *loca*
   Shaft of aedoeagus not evenly curved, distinctly narrowed at apical region ..... 3
3. Male plate with three blunt projections at apex ..... 3. *sicula*
   Male plate with two lateral projections at apical region ..... 4
4. Apical region of aedoeagus curved at more than a right angle to remainder of shaft, to point distinctly anteriorly ..... 5
   Apical region of aedoeagus curved at less than a right angle to remainder of shaft, not pointing anteriorly ..... 4. *triquetra*
5. Aedoeagus long, with shaft in lateral view approximately parallel-sided to near apical region; male plate slender, with the lowermost of the two apical processes pointed ..... 5. *acclina*
   Aedoeagus short, the shaft with a distinct dorsal protruberance before apical region in lateral view; male plate relatively stout, with the lowermost of the two apical processes rounded ..... 6. *frigida*

1. *Dicranoneura calipera* DeL. (Figs. 145, 908).—Length: 3.0-3.5 mm. Light brownish-yellow; forewing yellow on the clavus and along the veins, otherwise hyaline. The male plate and the aedoeagus are distinctive.

Southern Ontario.

2. *Dicranoneura loca* DeL. & Cald. (Figs. 141, 584, 909).—Length: 3.5 mm. Light yellowish-brown; forewing yellow on the clavus and along the veins, otherwise hyaline, but tinged brownish throughout in specimens from high altitudes. The aedoeagus and the apical region of the male plate are distinctive.

Mountains of British Columbia (up to 5,400 feet), Northwest Territories, southern Saskatchewan, southern and northern Manitoba, widely distributed and locally abundant in southern Ontario and southern Quebec, and found in Labrador.

3. *Dicranoneura sicula* DeL. & Cald. (Figs. 142, 585, 910).—Length: 4.0 mm. Light brownish-yellow; forewing yellow on the clavus and veins, otherwise hyaline. The aedoeagus and the apical region of the male plate are distinctive.

Southern British Columbia.

4. *Dicranoneura triquetra* DeL. & Cald. (Figs. 143, 586, 911).—Length: 3.5 mm. Light brownish-yellow; forewing with veins and clavus yellow, otherwise hyaline. The aedoeagus is distinctive.

Northwest Territories, southern Saskatchewan, and northern Manitoba.

5. *Dicranoneura acclina* DeL. & Cald. (Figs. 144, 912).—Length: 3.5 mm. Pale yellowish-brown; forewing with veins pale yellowish-brown, otherwise hyaline. The aedoeagus is distinctive.

Alaska, southern Saskatchewan, northern Manitoba, and southern Ontario.

6. *Dicranoneura frigida* Beir. (Figs. 146, 913).—Length: 3.5 mm. Yellowish-brown; forewing yellow on the clavus and veins. The aedoeagus and male plate are distinctive.

Northern Manitoba, on the border of the tundra.

### Genus 2. *Notus* Fieb.

*Notus sitka* (DeL. & Cald.) (Figs. 147, 914).—Length: 4.0-4.5 mm. Light brownish-yellow; forewing greenish-yellow, hyaline at apex. The aedoeagus is distinctive.

Widely distributed in Alaska up to altitude of 4,000 feet, Northwest Territories, and northern Manitoba. It occurs on grasses and sedges.

### Genus 3. *Dicraneura* Hardy (*Chloroneura* Walsh)

Specific characters are primarily in the form of the aedoeagus. The genus was revised by DeLong (1937) and Canadian species were discussed by Beirne (1952).

#### Key to species of *Dicraneura*

1. Aedoeagus with a long, anteriorly-directed spine arising from each side of shaft before apex or near middle ..... 2
   Aedoeagus without such spines ..... 6
2. Shaft of aedoeagus with a pair of short processes arising from anterior margin near middle ..... 3
   Shaft of aedoeagus without such processes ..... 9. *angustata*
3. Lateral spines of aedoeagus arising above bases of processes of anterior margin ..... 4
   Lateral spines of aedoeagus arising below bases of processes of anterior margin ..... 7. *rufula*
4. Lateral spines of aedoeagus curved upward at their tips in lateral or posterior view ..... 8. *feirde*
   Lateral spines of aedoeagus pointing downward in lateral or posterior view ..... 5
5. Apical process of aedoeagus straight, digitate, not sharply pointed ..... 5. *ossia*
   Apical processes of aedoeagus curved outward at their tips, sharply pointed ..... 6. *rubrala*
6. Aedoeagus with a single pair of processes at apical region ..... 7
   Aedoeagus with two pairs of processes at apical region ..... 8
7. Aedoeagus only slightly curved upward from base to apex in lateral view, with tips of apical processes curved forward ..... 1. *mali*
   Aedoeagus strongly curved upward at base of shaft, with tips of apical processes curved backward ..... 3. *absenta*
8. Posterior pair of apical processes of aedoeagus short, curved downward; shaft with a short projection at middle of anterior margin ..... 4. *carneola*
   Posterior pair of apical processes long, curved upward; shaft without projections on anterior margin ..... 2. *urbana*

1. *Dicraneura mali* (Prov.) (Figs. 148, 588, 915).—Length: 3.75-4.25 mm. Pale greenish-yellow; forewing whitish, tinged with pale greenish-yellow, especially along the veins. The aedoeagus is distinctive.

Widely distributed and locally common in southern Ontario, and found in southern Quebec, New Brunswick, and Prince Edward Island. It occurs in grasslands.

2. *Dicraneura urbana* Ball & DeL. (Figs. 149, 916).—Length: 3.75-4.0 mm. Pale brownish-yellow, the forewings hyaline between the veins. The aedoeagus is distinctive.

Southern Quebec and New Brunswick.

3. *Dicraneura absenta* DeL. & Cald. (Figs. 150, 917).—Length: 3.5-4.0 mm. Yellowish-green, sometimes with the disc of the pronotum dull reddish and with dull reddish streaks between the veins of the forewings. The aedoeagus is distinctive.

Widely distributed and locally abundant in southern British Columbia. It has been found on *Rubus* spp. and strawberry.

4. *Dicraneura carneola* (Stal) (*sitkana* Ball & DeL., *shoshone* DeL. & Cald.) (Figs. 151, 587, 918).—Length: 3.75-4.0 mm. Pale brownish-yellow with the veins of the forewings ochreous. Occasionally the vertex and pronotum are largely dull red and the forewing is streaked with dull red between the veins, except in the apical region. The aedoeagus is distinctive. There is geographical variation in the form of the aedoeagus: specimens from British Columbia have the apical margin more strongly oblique and with a definite rounded projection before the anterior processes whereas specimens from elsewhere in Canada have the apical margin less oblique and more nearly straight. The two forms intergrade.

Widely distributed and locally common in grassland areas in central and northern British Columbia and the grassland regions of Alberta, Saskatchewan, and Manitoba, and found in Northwest Territories.

5. *Dicraneura ossia* Beir. (Figs. 153, 919).—Length: 3.0-3.5 mm. Pale brownish-yellow, sometimes tinged with dull reddish on the vertex and pronotum and with reddish streaks between the veins of the forewing except in the apical region. The aedoeagus is distinctive.

Yukon and the grassland regions of Saskatchewan and Manitoba.

6. *Dicraneura rubrala* DeL. & Cald. (Figs. 152, 920).—Length: 3.0-3.5 mm. Pale yellowish with the vertex and pronotum largely dull reddish and the forewing streaked with reddish between the veins, except in the apical region which is hyaline with the veins reddish. The aedoeagus is distinctive.

Southern Manitoba and southern Ontario; apparently local.

7. *Dicraneura rufula* Gill. (Figs. 155, 921).—Length: 3.0-3.5 mm. Ochreous with the vertex and thorax largely dull reddish or reddish-brown and the forewing streaked with dull reddish between the veins, except in the apical region which is hyaline with the veins reddish. The aedoeagus is distinctive.

Southwestern British Columbia.

8. *Dicraneura feirde* Beir. (Figs. 154, 922).—Length: 3.25-4.0 mm. Pale yellowish or pale brownish-yellow, occasionally dull reddish or brownish on the vertex and pronotum and between the veins of the forewing, except in the apical region. The aedoeagus is distinctive.

Widely distributed in the mountain districts of southern British Columbia and southern Alberta.

9. *Dicraneura angustata* Ball & DeL. (Figs. 156, 923).—Length: 3.0-3.5 mm. Pale yellowish with broad, weak, longitudinal, orange-red bands on the vertex and pronotum; forewings pale greenish-yellow with the veins paler. The aedoeagus is distinctive.

Southern Ontario.

### Genus 4. *Dikrella* Oman

#### Key to species of *Dikrella*

Aedoeagus with dorsal arm about as long as shaft, shaft forked at apex ..... 2. *californica*
Aedoeagus with dorsal arm much shorter than shaft, shaft tapered to a point at apex ..... 1. *cruentata*

1. *Dikrella cruentata* (Gill.) (*lavata* McA., *rubricata* McA., *kansiensis* Laws., *nevadensis* Laws.) (Figs. 157, 924).—Length: 2.75-3.0 mm. Pale ochreous with a red patch in the centre of the vertex and two red bands on the pronotum; forewing whitish-hyaline with two longitudinal red bands and with the crossveins brownish. The aedoeagus is distinctive.

Southern Ontario and southern Quebec. Host plants: probably *Rubus* spp.

2. *Dikrella californica* Laws. (*imbellis* Laws.) (Figs. 158, 925).—Length: 2.75-3.0 mm. Pale whitish-ochreous, sometimes with the crossveins brownish. The aedoeagus is distinctive.

Southern British Columbia. Host plants: probably *Rubus* spp.

### Tribe Erythroneurini

Small insects that average about 2.75 mm. in length, usually with yellow or red markings on the forewings and body. The host plants are deciduous trees and shrubs. Some species cause damage that is of considerable economic importance. Specific characters are largely in the internal male genitalia, though in some instances the wing-pattern is of value. Females are usually difficult or impossible to name in the absence of associated males. Members of this tribe have not been collected intensively in Canada, and there is little doubt that many species additional to those discussed below, both named and undescribed, occur in Canada.

#### Key to genera and subgenera of Erythroneurini

1. Second apical cell of forewing obviously broadened at apex (Fig. 926) Genus 1. *Hymetta*
   Second apical cell of forewing narrowed throughout (Figs. 927, 930) (Genus 2. *Erythroneura*) ..... 2
2. Base of inner apical cell of forewing transverse (Fig. 927); pygofer hooks C-shaped with the ventral arm elongate ..... Subg. a. *Erythroneura*
   Base of inner apical cell of forewing oblique or angulate or both (Figs. 928, 930) ..... 3
3. Base of inner apical cell of forewing oblique and angulate (Fig. 930); male pygofer hooks with a lightly-sclerotized, joint-like basal region ..... Subg. b. *Erasmoneura*
   Base of inner apical cell of forewing oblique but not angulate (Figs. 928, 929); male pygofer without such basal region ..... 4
4. Vein CU of forewing meeting base of inner apical cell at its outer basal angle, and inner apical cell usually with a dark spot near base (Fig. 929); pygofer hooks slender and elongate ..... Subg. c. *Eratoneura*
   Vein CU of forewing meeting base of inner apical cell at some distance from its outer basal angle, and inner apical cell usually without a dark spot near base (Fig. 928); pygofer hooks short and stout ..... Subg. c. *Erythridula*

### Genus 1. *Hymetta* McA.

The North American species of this genus were revised by Fairbairn (1928).

*Hymetta balteata* McA. (*distincta* Fairb.) (Figs. 159, 593, 931).—Length: 3.5 mm. White, with the crossbands of the forewing brown or blackish-brown and margined with reddish or reddish-brown and the spots red. There is some variation in the extent and intensity of the dark markings. The markings and the internal male genitalia are distinctive.

Southern Ontario and southern Quebec. Host plant: oak.

### Genus 2. *Erythroneura*. Subgenus a. *Erythroneura* Fitch

This subgenus is also known as the *comes* group of *Erythroneura*. It includes species that are of economic importance as pests of grape and Virginia

creeper. The species hibernate as adults in leaf mould and dead leaves. They may be captured in large numbers by sifting such debris in fall or spring. Some of them undergo colour changes with the onset of cold weather. The North American species were revised by Beamer (1936).

**Key to species of *Erythroneura (Erythroneura)***

1. Markings of forewings as one or more distinct transverse bands ..... 2
   Markings of forewings not as distinct transverse bands, usually as irregular, angulate, longitudinal bands ..... 3
2. Base of forewing dark ..... 2. *vitis*
   Base of forewing pale ..... 4. *tricincta*
3. Aedoeagus without basal accessory processes; lower arm of pygofer hook very long; band of forewing usually broken at claval suture ..... 4
   Aedoeagus with basal accessory processes; lower arm of pygofer hook usually not very long; band of forewing usually not broken at claval suture ..... 5
4. Aedoeagus very slender in ventral view ..... 12. *ontari*
   Aedoeagus stout in ventral view ..... 11. *rubrella*
5. Accessory processes of aedoeagus each with a short projection on posterior margin near middle, beyond which the process is slender; style with apical processes long and slender ..... 1. *comes*
   Accessory processes of aedoeagus without such projections, and not obviously more slender on apical half; style with apical processes short ..... 6
6. Accessory processes of aedoeagus angled at middle in lateral view ..... 7
   Accessory processes straight or curved, not angled ..... 8
7. Tips of accessory processes reflexed; ventral arm of pygofer hook very long, curved ..... 10. *prima*
   Tips of accessory processes not reflexed; ventral arm of pygofer hook not very long, straight ..... 7. *vitifex*
8. Aedoeagus without distinct lateral processes; style with apical process reduced to a blunt elevation ..... 9
   Aedoeagus with distinct, pointed lateral processes; style with apical process spine-like ..... 10
9. Accessory processes of aedoeagus crossing each other in ventral view; upper arm of pygofer hook longer ..... 8. *caetra*
   Accessory processes not crossing each other; upper arm of pygofer hook shorter 9. *rosa*
10. Tips of accessory processes of aedoeagus strongly curved outward and backward ..... 3. *bistrata*
    Tips of accessory processes not or only weakly curved outward or backward ..... 11
11. Scutellum with black basal triangles ..... 6. *coloradensis*
    Scutellum without black markings ..... 5. *ziczac*

1. *Erythroneura* (*Erythroneura*) *comes* (Say) grape leafhopper, cicadelle de la vigne, (Figs. 160, 591, 932).—Length: 2.75 mm. Pale yellowish-white with markings yellowish. The markings become light reddish in autumn and red in winter. The red fades to light yellow in the spring. The short processes at the outer margin of each accessory process of the aedoeagus is distinctive.

Widely distributed in southern Ontario and southern Quebec. Host plant: grape. It is the most common species on cultivated grapes. It is usually abundant and, in southern Ontario, sometimes increases to outbreak proportions in dry weather. Outbreaks tend to be most frequent in vineyards near bushland or wasteland, where suitable hibernation sites are numerous. The adults hibernate under loose bark, in rotten wood, fallen leaves, grass tufts, and similar situations. They become active about the end of April and feed on a variety of kinds of plants. Late in May and early in June, when the third leaf of the grape is showing, they migrate to vineyards. Each female lays about 70 eggs under the epidermis of the undersides of the leaves. These hatch in about 26 days. The nymph, which has five instars, reaches maturity in about 24 days. Nymphs from eggs laid by overwintered adults are present from the middle of June to the end of August. Adults from nymphs that mature in July lay eggs that

produce a partial second brood of nymphs from mid-August to October. The nymphs and adults feed on the undersides of the leaves, preferably close to the veins and on the lower leaves. This produces a mottling on the leaves and sometimes kills part or all of them. Severely damaged foliage falls prematurely. The damage to the foliage affects the size and quality of the fruit.

2. *Erythroneura* (*Erythroneura*) *vitis* (Harr.) (Figs. 161, 590, 933).—Length: 3.0 mm. Yellowish or whitish-yellow, with the markings of the vertex and thorax and the basal and median crossbands of the forewings reddish-brown, red, or orange and usually red-margined, the crossveins red, and the apical cells suffused with greyish-brown or fuscous. The var. *coronata* McA. has the crossveins and the anterior and median bands of the forewing connected to one another by red lines along the veins. The colour and markings and the male genitalia are distinctive.

Widely distributed in southern Ontario and southern Quebec. Host plant: grape; sometimes common on Clinton vines.

3. *Erythroneura* (*Erythroneura*) *bistrata* McA. (Figs. 162, 934).—Length: 2.75 mm. Ochreous with the markings light yellowish-brown, orange, or red, the crossveins red, and the apical cells sometimes smoky. There is much variation in colour. The aedoeagus is distinctive.

Southern Manitoba and southern Ontario. Host plant: grape.

4. *Erythroneura* (*Erythroneura*) *tricincta* Fitch, the three-banded leafhopper, cicadelle à trois bandes, (Figs. 163, 592, 935).—Length: 3.0 mm. Yellow with the dark band of the pronotum and scutellum dark brown or black, the median band of the forewing reddish-brown becoming black toward the costa, and the apical cells greyish-fuscous. The markings and the genitalic characters are distinctive.

Widely distributed in southern Ontario and southern Quebec. Host plant: grape. It is very common, and is occasionally more abundant than *comes* in the Niagara Peninsula, especially in vineyards near the river. The life-history is similar to that of *comes*.

5. *Erythroneura* (*Erythroneura*) *ziczac* Walsh, Virginia creeper leafhopper, (Figs. 164, 165, 589, 936).—Length: 2.75 mm. Ochreous with the markings yellowish-brown, brown, or reddish-brown. Specimens collected in the autumn tend to have the markings darker and more distinctly reddish than specimens collected in the summer, with the crossveins and the marginal markings of the forewings and the markings of the vertex and thorax largely red. There is also variation in the extent of the dark markings. The var. *walshi* Beam. (Fig. 165) has relatively narrow markings and usually the basal two-thirds of the pronotum pale.

Widely distributed in the southern parts of British Columbia, Alberta, Saskatchewan, Manitoba, Ontario, and Quebec. Host plants: Virginia creeper and grape. It often becomes so abundant on Virginia creeper as to damage the foliage. It is less common on grape than related species in most areas, but appears to be the most common grape-feeding species in the Okanagan Valley of British Columbia. The life-history is similar to that of *comes*, except that the adults of the first brood appear about two weeks earlier than those of that species.

6. *Erythroneura* (*Erythroneura*) *coloradensis* (Gill.) (Figs. 166, 937).—Length: 2.75 mm. Pale yellowish-white with the markings reddish-orange. The black basal triangles of the scutellum and the genitalic characters are distinctive.

Southern Ontario. Host plant: Virginia creeper.

7. *Erythroneura* (*Erythroneura*) *vitifex* Fitch (Figs. 167, 938).—Length: 2.75 mm. Pale yellowish-white with the markings orange-red. The genitalic characters are distinctive.

Southern Ontario. Host plant: grape.

8. *Erythroneura* (*Erythroneura*) *caetra* McA. (Figs. 168, 939).—Length: 2.75 mm. Pale yellowish-white with the markings brown or dark reddish-brown, usually red-margined. This species is closely related to *rosa*, from which it may be distinguished primarily by the relatively longer upper arm of the pygofer hook.

Southern British Columbia.

9. *Erythroneura* (*Erythroneura*) *rosa* Rob. (Figs. 169, 940).—Length: 2.75 mm. Pale yellowish-white with the markings brown, margined red, or reddish-brown. The genitalic characters are distinctive.

Southern Manitoba and southern Ontario. Host plant: willow.

10. *Erythroneura* (*Erythroneura*) *prima* Beam. (Figs. 170, 941).—Length: 2.75 mm. Yellowish-white with the markings reddish or reddish-brown. The genitalic characters are distinctive.

Southern Quebec.

11. *Erythroneura* (*Erythroneura*) *rubrella* McA. (Figs. 171, 942).—Length: 2.75 mm. Yellowish-white with the markings red or orange-red. The genitalic characters are distinctive.

Southern Ontario. Host plant: possibly dogwood.

12. *Erythroneura* (*Erythroneura*) *ontari* Rob. (Figs. 172, 943).—Length: 2.75 mm. Whitish or pale yellowish-white with the markings red and the costal plaque pale yellow. The genitalic characters are distinctive.

Southern Alberta, southern Saskatchewan and southern Ontario.

### Genus 2. *Erythroneura*. Subgenus b. *Erasmoneura* Young

This subgenus is also known as the *vulnerata* group of *Erythroneura*. It was revised by Beamer (1946). Some species that are at present undescribed are known to occur in Canada, and it is likely that described species additional to those listed below will be found. Identification of the species is on a basis of characters of the internal male genitalia.

1. *Erythroneura* (*Erasmoneura*) *vulnerata* Fitch (*gradata* Rob.) (Figs. 173, 944).—Length: 2.75 mm. Ochreous with the markings light reddish-brown except for a large yellow area, bordered at each end with dark brown, in the costal region of the forewing, brownish or light fuscous areas at the apices of the basal cells and in the apical cells, and a red line on the crossveins near the costa. The male genitalia are distinctive. There is some variation in the shape of the pygofer hooks.

Common and widely distributed in southern Ontario and southern Quebec. Host plants: grape, Virginia creeper, and probably other plants.

2. *Erythroneura* (*Erasmoneura*) *nigra* Gill. (*nigridorsum* DeL.) (Figs. 174, 945).—Length: 3.0 mm. Vertex and thorax blackish with the markings yellow; forewings blackish or dark fuscous with the markings white. There is variation in the extent of the pale areas. The male genitalia are distinctive.

Southern Ontario. Host plant: probably *Polygonium* sp.

3. *Erythroneura* (*Erasmoneura*) *calva* Beam. (Figs. 175, 946).—Length: 3.0 mm. Vertex and thorax pale yellow with the lateral markings of the pronotum and the basal triangles of the scutellum brown and the remaining dark markings light red; forewing ivory white with the dark areas of the clavus and of the

neighbouring parts of the corium light red and the remaining dark areas light brownish or weak fuscous. The male genitalia are distinctive.

Southern Manitoba.

**Genus 2. *Erythroneura*. Subgenus c. *Erythridula* Young**

This subgenus is also known as the *obliqua* group of *Erythroneura*. Over 110 species have so far been found in North America, and those discussed below represent perhaps a quarter of the species that actually inhabit Canada. Most of the species are striped with red, orange or yellow. Species that are still undescribed and described species that are impossible to name reliably from existing literature have been collected in Canada. Identification of the species is on a basis of characters of the internal male genitalia. The group was revised by Beamer (1930), but many species were subsequently described.

1. *Erythroneura* (*Erythridula*) *fumida* (Gill.) (Figs. 176, 947).—Length: 2.75 mm. Vertex and thorax yellowish, suffused with orange-brown; forewing whitish with orange-brown longitudinal bands, the basal regions of the apical cells and the apical regions of the basal cells fuscous, and the costal region reddish at two-thirds. The male genitalia are distinctive.

Southern Ontario and southern Quebec.

2. *Erythroneura* (*Erythridula*) *noeva* (Gill.) (Figs. 177, 948).—Length: 3.0 mm. Vertex and pronotum pale yellowish with the bands red; scutellum dark brown, reddish at the sides; forewings whitish with the markings red. The male genitalia are distinctive.

Southern Ontario. Host plant: black walnut.

3. *Erythroneura* (*Erythridula*) *aspera* Beam. & Griff. (Figs. 178, 949).—Length: 3.0 mm. Vertex and pronotum pale yellowish with the bands red or orange-red; scutellum reddish with the basal triangles usually dark brown; forewings whitish with the bands red or orange-red, and usually with weak fuscous suffusions at either side of the crossveins. The male genitalia are distinctive.

Southern British Columbia, widely distributed, southern Alberta, and southern Saskatchewan.

4. *Erythroneura* (*Erythridula*) *dolosa* Beam. & Griff. (Figs. 179, 950).—Length: 3.0 mm. Vertex and pronotum pale yellowish with the bands red or orange; scutellum brownish with the basal triangles dark brown; forewing pale yellowish with the bands red or orange and with the apical cells tinged with fuscous. The male genitalia are distinctive.

Southwestern British Columbia.

5. *Erythroneura* (*Erythridula*) *nitida* Aut. & Johns. (Figs. 180, 951).—Length: 2.75 mm. Pale yellowish with the bands red or orange and with a weak fuscous tinge in the apical cells of the forewing. The male genitalia are distinctive.

Widely distributed in southern Ontario.

6. *Erythroneura* (*Erythridula*) *plena* Beam. (Figs. 181, 952).—Length: 3.0 mm. Vertex and thorax whitish-yellow with the markings yellow, orange, or reddish; forewings whitish with the bands yellow, orange, or reddish and usually with weak, fuscous suffusions at either side of the crossveins. The male genitalia are distinctive.

Southern British Columbia and southern Ontario. Host plant: peach. Formerly common but now much reduced by insecticides.

7. *Erythroneura* (*Erythridula*) *nondescripta* Johns. (Figs. 182, 953).—Length: 3.0 mm. Vertex and thorax pale yellowish; forewings whitish with the bands pale yellow. The male genitalia are distinctive.

Southern Ontario.

8. *Erythroneura* (*Erythridula*) *insigna* Beam. & Griff. (Figs. 183, 954).—Length: 2.75 mm. Vertex and thorax pale yellowish with the markings red, orange, or yellow; forewings whitish with the bands orange or red, and usually with weak fuscous suffusions in the apical cells. The male genitalia are distinctive.

Southern Manitoba, southern Ontario, and southern Quebec.

9. *Erythroneura* (*Erythridula*) *flammigera* Geoff. (*blandula* Ross., *gracilis* Schell.) (Figs. 184, 955).—Length: 3.0 mm. Vertex and pronotum ochreous, usually with a broad, brown, median band; scutellum dark brown; forewing whitish with the band red and the apical cells suffused with fuscous. The male genitalia are distinctive.

Southwestern British Columbia. Host plant: cherry. An introduced European species first found in North America, at Vancouver, in 1950.

### Genus 2. *Erythroneura*. Subgenus d. *Eratoneura* Young

This subgenus is also known as the *maculata* group of *Erythroneura*. Most of the species are spotted with red or yellow. Over 130 species have been found so far in North America, and those discussed below represent possibly a quarter of the total likely to be found in Canada. Identification of the species is on characters of the internal male genitalia. The group was revised by Beamer (1931) but a considerable number of species were described subsequently and there is a number, including some from Canada, that are still undescribed.

1. *Erythroneura* (*Eratoneura*) *basilaris* (Say) (Figs. 185, 956).—Length: 3.0 mm. Vertex and pronotum pale yellowish with the markings red or orange; scutellum brown, or pale yellowish with the markings red or orange; forewing with the basal region orange-brown, a fuscous spot at the base of the first apical cell and a second such spot at the middle of the costa. The male genitalia are distinctive.

Southern Ontario.

2. *Erythroneura* (*Eratoneura*) *affinis* Fitch (Figs. 186, 957).—Length: 3.0 mm. Vertex and thorax whitish-yellow with pale lemon-yellow markings; forewing whitish with pale lemon-yellow markings on the basal half, the veins of the apical half red, a fuscous spot at the base of the first apical cell and a second such spot at the middle of the costa. The male genitalia are distinctive.

Southern Ontario.

3. *Erythroneura* (*Eratoneura*) *coxi* Ross & DeL. (Figs. 187, 958).—Length: 2.75 mm. Whitish with numerous light red or pinkish spots and with a black spot at the base of the first apical cell. The male genitalia are distinctive.

Southern Ontario. Host plants: *Rubus* spp.

4. *Erythroneura* (*Eratoneura*) *direpta* Knull (Figs. 188, 959).—Length: 2.75 mm. Pale yellowish with the markings yellow, orange, or red, a fuscous spot at the base of the first apical cell and a second such spot at the middle of the costa.

Southern Manitoba, and widely distributed in southern Ontario. Host plant: ironwood.

5. *Erythroneura* (*Eratoneura*) *spala* Ross & DeL. (Figs. 189, 960).—Length: 2.75 mm. Pale whitish-yellow with the markings yellow or weak orange and

with a fuscous spot at the base of the first apical cell. The male genitalia are distinctive.

Southern Manitoba. Host plant: probably hazel.

6. *Erythroneura* (*Eratoneura*) *curvata* Beam. (Figs. 190, 961).—Length: 3.0 mm. Pale yellowish with the markings blood-red and with a fuscous spot at the base of the first apical cell. The male genitalia are distinctive.

Southern Ontario.

7. *Erythroneura* (*Eratoneura*) *maculata* (Gill.) (Figs. 191, 962).—Length: 2.75 mm. Whitish with the markings bright red and with a black spot at the base of the first apical cell and a second such spot at the middle of the costa. The male genitalia are distinctive.

Southern Ontario. Host plant: sumac.

### Tribe Typhlocybini

A large group of small, rather fragile insects. Specific characters are in the internal male genitalia. The females, and often the males, usually cannot be identified reliably on a basis of external characters. The nymphs mostly feed on woody plants. *Typhlocyba* and related genera were revised by Christian (1953).

#### Key to genera of Typhlocybini

1. Legs without green colour; hindwing with submarginal vein absent at apex (Fig. 905) 2
   Legs with some green colour; hindwing with submarginal vein present at apex (Fig. 904) ..... 8. *Empoasca*
2. Hindwing with posterior branch of vein R not fused with apical portion of vein M 1 + 2, and vein R + M absent ..... 3
   Hindwing with posterior branch of vein R fused with apical portion of vein M 1 + 2, and vein R + M present ..... 4
3. Margin of style with angular projection before apex ..... 2. *Eupteryx*
   Margin of style without angular projection before apex ..... 1. *Eupteroidea*
4. Shaft of aedoeagus flattened and membranous, situated between a pair of long, curved processes ..... 3. *Ossiannilssonola*
   Shaft of aedoeagus strongly sclerotized ..... 5
5. Style with a distinct angular projection on outer margin before apex ..... 4. *Ribautiana*
   Style without such projection ..... 6
6. Aedoeagus with three pairs of apical processes, and with broad, thin, longitudinal plates on anterior surface of shaft ..... 6. *Empoa*
   Aedoeagus with not more than two pairs of apical processes, these sometimes branched, and usually without a plate on anterior surface of shaft ..... 7
7. Aedoeagus with one or no pair of apical processes usually with a pair of large processes from base of shaft ..... 5. *Typhlocyba*
   Aedoeagus with two pairs of apical processes, frequently branched, and without processes from base ..... 7. *Edwardsiana*

### Genus 1. *Eupteroidea* Young

*Eupteroidea stellulata* (Burm.) (Figs. 192, 963).—Length: 4.0-4.5 mm. White with the markings of the forewings brown and dark brown. The colour and markings, the emarginate apex of the forewing, and the male genitalia are distinctive.

Locally common in southern Ontario. Host plants: lime, cherry, pearl bush, and probably other woody plants.

### Genus 2. *Eupteryx* Curt.

#### Key to species of *Eupteryx*

1. Vertex with definite black spots; pronotum largely pale ..... 2
   Dark colouration of vertex not in the form of definite black spots; pronotum usually dark ..... 1. *flavoscuta*
2. Vertex with three black spots; black spots of pronotum, when present, small ..... 3. *melissae*
   Vertex with two black spots; pronotum with large black spots ..... 2. *atropunctata*

1. *Eupteryx flavoscuta* Gill. (Figs. 193, 964).—Length: 3.5-4.0 mm. Dark brownish-fuscous with the anterior margin of the vertex, the median area of the scutellum, the median area of the clavus, and the costal region of the forewing yellow or greenish-yellow, and with hyaline areas in the apical cells. Occasionally the median area of the forewing is light brown or yellowish. The colour, markings, and genitalic characters are distinctive.

Southern Ontario and southern Quebec. Widely distributed and locally abundant. Host plants: probably ferns; it also occurs on basswood.

2. *Eupteryx atropunctata* (Goeze) (*carpini* Geoff., *picta* Fab., *aureola* Boh.) (Fig. 194, 965).—Length: 3.0-3.5 mm. Greenish-yellow, the forewing becoming darker toward apex, with the spots of the vertex and thorax black and the dark markings of the forewing fuscous. The markings and the genitalic characters are distinctive.

Widely distributed in southern Ontario and southern Quebec. Host plant: hollyhock.

3. *Eupteryx melissae* Curt. (*collina* Flor., *quinquemaculata* Bak.) (Figs. 195, 966).—Length: 3.0 mm. Pale yellowish-green, the forewings semi-hyaline, with the spots of the vertex and pronotum black and the remaining dark markings of the body and forewings brown. The markings and the genitalic characters are distinctive.

Southern British Columbia and southern Ontario. Host plants: catnip, salvia, and probably related plants.

### Genus 3. *Ossiannilssonola* Christ.

#### Key to species of *Ossiannilssonola*

1. Dark markings of forewing restricted to three spots at the apices of the basal cells just anterior to the crossveins ..... 3. *clymene*
   Dark markings of forewing not as above ..... 2
2. Dark markings of forewing as two transverse bands ..... 3
   Dark markings of forewing not as above ..... 4
3. Posterior transverse band of forewing solid, unbroken ..... 2. *volans*
   Posterior transverse band of forewing made up of six distinctly separated spots ..... 4. *duplicata*
4. Pronotum with dark markings that are continuous posteriorly with a dark line along the commissure ..... 5. *phryne*
   Not marked as above; forewing with dark markings bordering the crossveins 1. *berenice*

1. *Ossiannilssonola berenice* (McA.).—Yellow or orange-yellow; forewing hyaline apically, sometimes with the veins yellow or orange, with black spots at the apices of the basal cells and less distinct black spots at the bases of the apical cells.

Recorded from southern Ontario (Christian, 1953). Host plant: probably oak.

2. *Ossiannilssonola volans* (McA.) (Figs. 197, 601, 967).—Length: 3.75-4.0 mm. Whitish-yellow with the transverse bands of the forewing dark brown. There is variation in the size of the dark bands and in the intensity of their colour; moreover, in some specimens the bands cross the wings diagonally. The internal male genitalia are distinctive.

Southern British Columbia, southern Ontario, New Brunswick, and Nova Scotia. Host plants: elm and probably black cherry, oak, and other trees.

3. *Ossiannilssonola clymene* (McA.) (Figs. 196, 600, 968).—Length: 3.5-3.75 mm. Yellowish-white, the forewing with the apical regions of the basal cells dark brown. There is variation in the size of these dark areas. The internal male genitalia are distinctive.

Southern Ontario. Host plant: probably oak.

4. *Ossiannilssonola duplicata* (McA.) (Figs. 198; 969).—Length: 3.0 mm. Whitish or yellowish-white with the markings of the forewings brown. The posterior dark band of the forewing is divided by the light-coloured veins into six spots. These spots, and the internal male genitalia, are distinctive.

Southern Ontario. Host plants: probably *Crataegus* spp.

5. *Ossiannilssonola phryne* (McA.) (Figs. 199, 970).—Length: 3.5 mm. Whitish or pale yellowish-white with the markings brown, becoming blackish at the commissural and scutellar margins. There is variation in the extent of the dark markings, which are sometimes reduced or absent. The internal male genitalia are distinctive.

Southern Ontario. Host plant: probably oak.

### Genus 4. *Ribautiana* Zakh.

#### Key to spcies of *Ribautiana*

1. Length: 3.5-4.0 mm.; forewings greenish-yellow; abdomen black underneath; shaft of aedoeagus without processes ..... 1. *ulmi*
   Length: 3.0 mm.; forewings white or yellow; abdomen yellow underneath; shaft of aedoeagus with processes ..... 2
2. Aedoeagus with a pair of processes at or before middle of shaft ..... 3
   Aedoeagus with a pair of processes at apex of shaft only ..... 4
3. Apical region of aedoeagus curved posteriorly in lateral view, with one or more pairs of short apical processes that are directed posteriorly ..... 5. *unca*
   Apical region of aedoeagus not curved posteriorly in lateral view, with a single posteriorly-directed process and a pair of short, anteriorly-directed processes ..... 2. *tenerrima*
4. Apical half of shaft of aedoeagus almost straight, and lower pair of apical processes only slightly curved ..... 3. *parapiscator*
   Apical half of shaft of aedoeagus strongly curved posteriorly, and lower pair of apical processes curved to parallel curve of shaft ..... 4. *foliosa*

1. *Ribautiana ulmi* (L.) (*ocellata* Curt.) (Figs. 200, 594, 971).—Length: 3.5-4.0 mm. Pale greenish-yellow with the spots of the vertex black; male with a black spot at the middle of the anterior margin of the pronotum; forewing yellowish-green or greenish, usually smoky toward the apex. The relatively large size, colour, and the aedoeagus are distinctive.

Widely distributed and locally abundant in southern British Columbia, southern Ontario, and Nova Scotia. It was probably introduced from Europe. Host plant: elm.

2. *Ribautiana tenerrima* (H.-S.) (*rubi* Hardy, *misella* Boh.), the bramble leafhopper, (Figs. 201, 595, 972).—Length: 3.0 mm. White or light yellow, the forewing smoky in the apical region. The aedoeagus is distinctive.

Southwestern British Columbia. First found in 1947 and now a common pest of loganberry. It probably was introduced from Europe. Host plants: *Rubus* spp.

3. *Ribautiana parapiscator* Christ. (Figs. 202, 973).—Length: 2.75 mm. Whitish or yellowish-white, the scutellum sometimes light brownish and the forewing usually smoky in the apical region. The aedoeagus is distinctive.

Southern Ontario. Host plant: ironwood.

4. *Ribautiana foliosa* (Knull) (Figs. 203, 974).—Length: 3.0 mm. Whitish or pale yellowish-white, the forewing with blackish spots on the ends of the apical veins. The aedoeagus is distinctive.

Southern Ontario. Host plant: blue beech.

5. *Ribautiana unca* (McA.) (*surda* DeL. & Johns.) (Figs. 204, 975).—Length: 3.0 mm. Whitish or pale yellowish-white, the forewings with blackish spots at the ends of the apical veins. The aedoeagus is distinctive.

Widely distributed in the southern parts of British Columbia, Manitoba, and Ontario, and found in Northwest Territories.

### Genus 5. *Typhlocyba* Germ. (*Anomia* Fieb.)

### Key to species of *Typhlocyba*

1. Forewing with well-defined dark markings ..... 2
   Forewing without dark markings ..... 3
2. Forewing with red or orange spots ..... 1. *quercus*
   Forewing with a dark transverse band ..... 7. *transviridis*
3. Aedoeagus with a pair of large long atrial processes arising at or near base of shaft, and with or without apical processes ..... 6
   Aedoeagus without atrial processes, and with a pair of apical processes ..... 4
4. Apical processes of aedoeagus sharply bent downward at more than a right angle to shaft ..... *Edwardsiana alcorni*
   Apical processes more or less in line with shaft ..... 5
5. Apical processes half as long as shaft, each broadened at middle ..... 11. *persephone*
   Apical processes less than one-fourth as long as shaft, each slender and sinuate 12. *tortosa*
6. Aedoeagus with a pair of apical processes ..... 2. *arsinoe*
   Aedoeagus without apical processes ..... 7
7. Atrial processes of aedoeagus arising at or near base of shaft ..... 8
   Atrial processes fused with shaft for one-quarter of its length ..... 9. *cassopeia*
8. Shaft of aedoeagus flattened laterally and apically into a broad, thin plate ..... 5. *pomaria*
   Shaft of aedoeagus not flattened laterally and apically ..... 9
9. Atrial processes of aedoeagus broadly flattened ..... 6. *melite*
   Atrial processes not broadly flattened ..... 10
10. Shaft of aedoeagus arising much above bases of atrial processes ..... 11
    Shaft of aedoeagus arising between or only slightly above bases of atrial processes ..... 12
11. Atrial processes of aedoeagus fused for basal fourth; style with a digitate projection near middle ..... 3. *modesta*
    Atrial processes not fused on basal fourth; style without such projection . 4. *hockingensis*
12. Shaft of aedoeagus situated anterior to atrial processes throughout its length ..... 10. *crassa*
    Shaft of aedoeagus situated between or posterior to atrial processes ..... 8. *putmani*

1. *Typhlocyba quercus* (Fab.) (*fasciata* Toll.) (Figs. 205, 596, 976).—Length: 3.0-3.5 mm. Head and thorax yellowish-white, the head sometimes with reddish or orange bands near the anterior margin, the pronotum sometimes with a red or orange spot in centre and occasionally with red or orange bands at the sides and anterior margin, and the scutellum sometimes tinged with brownish and occasionally with the basal triangles red or orange; forewing yellowish-white with six red or orange-red spots on the clavus and adjoining parts of the corium and with a brown suffusion in the cells in the region of the crossveins. The colour and markings are distinctive within the genus, though the species resembles superficially species of *Erythroneura*. The internal male genitalia are distinctive.

Southern British Columbia, widely distributed. The species was first found in North America, in gardens at Vancouver, in 1948 and probably was artificially introduced from Europe. Host plant: cherry.

2. *Typhlocyba arsinoe* McA. (Figs. 206, 977).—Length: 3.25-3.5 mm. White or pale yellow; forewings white, yellow, or orange-yellow. The internal male genitalia are distinctive.

Southern Ontario.

3. *Typhlocyba modesta* Gibs. (Figs. 208, 979).—Length: 3.5-4.0 mm. Whitish or pale yellowish-white, without dark markings. The internal male genitalia are distinctive.

Southern Ontario and southern Quebec. Host plant: sugar maple.

4. *Typhlocyba hockingensis* Knull (Figs. 207, 599, 978).—Length: 3.25-3.5 mm. Yellowish-white, without dark markings. The internal male genitalia are distinctive.

Alaska, British Columbia, southern Ontario, and southern Quebec. Host plants: woody plants.

5. *Typhlocyba pomaria* McA., the white apple leafhopper, cicadelle blanche du pommier (Figs. 209, 980).—Length: 3.25-3.5 mm. Yellowish-white or pale yellow, without dark markings, the male with the face orange. The internal male genitalia are distinctive. There is some variation in the thickness of the aedoeagus.

Widely distributed in Alaska, British Columbia, Saskatchewan, Ontario, Quebec, and Nova Scotia. Host plants: apple, *Prunus* spp., hawthorn, and probably other woody plants.

6. *Typhlocyba melite* McA. (Figs. 210, 981).—Length: 3.5-3.75 mm. Yellowish-white without dark markings. The internal male genitalia are distinctive.

Southern Manitoba and southern Ontario. Host plants: *Ribes* spp.

7. *Typhlocyba transviridis* Christ. (Figs. 211, 982).—Length: 3.25-3.5 mm. Pale yellow with the transverse band of the forewings yellowish-brown. Fresh specimens are bright green with the transverse band greenish-brown. The markings and the internal male genitalia are distinctive.

Southern Ontario. Host plant: probably basswood.

8. *Typhlocyba putmani* Knull (Figs. 212, 597, 983).—Length: 4.0-4.25 mm. Whitish-yellow without dark markings. The internal male genitalia are distinctive.

Southern Ontario. Host plant: probably dogwood.

9. *Typhlocyba cassopeia* Knull (Figs. 213, 598, 984).—Length: 3.25-3.5 mm. Pale yellow without dark markings. Fresh specimens are light green. The internal male genitalia are distinctive.

Southern Ontario. Host plants: *Prunus* spp.

10. *Typhlocyba crassa* DeL. & Johns. (Figs. 214, 985).—Length: 3.5-3.75 mm. Yellowish-white without dark markings. The internal male genitalia are distinctive.

Southern Ontario. Host plant: black cherry.

11. *Typhlocyba persephone* McA. (Figs. 215, 986).—Length: 3.5 mm. Pale yellow or orange-yellow, without dark markings. The internal male genitalia are distinctive.

Southern Ontario and southern Quebec. Host plant: maple.

12. *Typhlocyba tortosa* Ross & DeL. (Figs. 216, 987).—Length: 3.0 mm. Pale yellow or whitish, the forewing hyaline toward apex. The aedoeagus is distinctive.

Southern Ontario. Host plant: ironwood.

### Genus 6. *Empoa* Fitch

Most species of this genus are difficult to name reliably, as their genitalia do not show specific characters. Specific characters of such species are the host plants and the colour pattern. The latter is not always reliable because of individual variation and because the markings often do not develop fully until some time after the insect has become mature. Thus, teneral, partly coloured, specimens of the *gillettei* group resemble fully coloured specimens of the *casta* group and teneral specimens of the *casta* group resemble fully coloured specimens of the *querci* group. Additional species of *Empoa* which were discussed by Christian (1953) may occur in Canada.

#### Key to species-groups and species of *Empoa*

1. Forewing without dark band in apical region; median plate on anterior margin of shaft of aedoeagus not produced into a hook ..... 11. *albicans*
   Forewing with dark band in apical region; median plate on anterior margin of shaft of aedoeagus produced into a hook ..... 2

2. Hook on anterior margin of shaft of aedoeagus arising at or above middle of plate ..... 10. *spinosa*
Hook on anterior margin of shaft of aedoeagus arising from base of plate ..... 3
3. Pronotum dark brown ..... 9. *vestita*
Pronotum pale ..... 4
4. Scutellum brown or black; forewing with two dark, transverse bands. *E. gillettei* group ..... 5
Scutellum pale; forewing with one or two dark, transverse bands ..... 9
5. Median band of forewing extended to base of wing ..... 6
Median band of forewing not extended to base of wing ..... 7
6. On basswood; median band of forewing not connected to apical band ..... 6. *venusta*
Possibly on *Salix* spp.; median band of forewing usually connected to apical band ..... 7. *scripta*
7. On alder; apical band of forewing usually as broad as or broader than median band and median band usually one-third or more as broad as width of wing ..... 8. *latifasciata*
Apical band of forewing usually narrower than median band and median band usually less than one-third as broad as width of wing ..... 8
8. On sugar maple; forewing usually with dark spot absent from apex of inner basal cell ..... 5. *acericola*
On alder; forewing with dark spot present at apex of inner basal cell ..... 4. *gillettei*
9. Forewing with median and apical dark bands. *E. casta* group ..... 3. *casta*
Forewing with a single dark band in apical region. *E. querci* group ..... 10
10. On oak; forewing with three dark spots in apical region ..... 1. *querci*
On elm; forewing with four or more dark spots in apical region ..... 2. *elmata*

1, 2. *Empoa querci* group: 1, *E. querci* Fitch and 2, *E. elmata* Christ. (Fig. 217).—Length: 3.25-3.5 mm. Yellow or yellowish-white with the markings of the forewing dark brown. The markings are distinctive for the group.

Specimens referable to *querci* and *elmata* have been collected in southern Ontario.

3. *Empoa casta* (McA.) (Fig. 218).—Length: 3.25-3.75 mm. Pale yellow or yellowish-white with the transverse bands of the forewing dark brown. The markings are distinctive for the group. Other known species of the *casta* group have not been found in Canada.

Southern Ontario and southern Quebec.

4-8. *Empoa gillettei* group: 4, *E. gillettei* Van D. (Figs. 219, 602, 988), 5, *E. acericola* Christ., 6, *E. venusta* (McA.) (Figs. 221, 603), 7, *E. scripta* (McA.), and, 8, *E. latifasciata* Christ. (Fig. 220).—Length: 3.25-3.75 mm. Yellow or yellowish-white with the scutellum brown or blackish and the transverse bands of the forewings brown. The dark scutellum is distinctive for the group. *E. spinosa* also has a dark scutellum but has distinct genitalic characters.

Specimens referable to *E. acericola* have been found in southern Ontario, to *E. venusta* in southern Ontario and southern Quebec, to *E. scripta* and *E. latifasciata* in southern British Columbia, and to *E. gillettei* in British Columbia, Northwest Territories, southern Ontario, southern Quebec, and New Brunswick.

9. *Empoa vestita* (McA.) (Fig. 222).—Length: 3.25-3.5 mm. Yellowish or greenish with the markings dark brown. The dark pronotum, and usually also the head, is distinctive.

Southern Quebec. Host plant: elm.

10. *Empoa spinosa* (Beam.) (Figs. 223, 604, 989).—Length: 3.75-4.25 mm. Yellowish or whitish-yellow with the scutellum and the transverse bands of the forewing dark brown. The aedoeagus is distinctive. On a basis of external characters this species resembles members of the *gillettei* group.

Alaska and northern Manitoba. Host plant: huckleberry.

11. *Empoa albicans* Walsh (*pallens* McA., *cymba* McA., *grata* McA.) (Figs. 224, 605, 990).—Length: 4.0-4.5 mm. Pale yellow or yellowish-white,

the forewing sometimes with a brown spot near the apex of the clavus or with its basal half more or less suffused with brown, becoming dark brown toward the commissure. In well-marked specimens the scutellum is dark brown. The colour pattern and the aedoeagus are distinctive.

Southern Ontario, southern Quebec, and Nova Scotia. Host plant: probably *Acer* spp.

### Genus 7. *Edwardsiana* Jazyk. (Zach.)

#### Key to species of *Edwardsiana*

1. Aedoeagus apparently with a single pair of processes at apex ..... 1. *alcorni*
   Aedoeagus with two or more pairs of processes at apex ..... 2
2. Apex of aedoeagus with two pairs of processes and one median unpaired process ..... 9. *australis*
   Aedoeagus with paired processes only ..... 3
3. Apical processes of aedoeagus unbranched ..... 10
   At least one pair of apical processes branched ..... 4
4. Two pairs of apical processes branched ..... 5
   Only the median pair of apical processes branched ..... 6
5. Median pair of processes branched at base ..... 3. *lethierryi*
   Median pair of processes branched near middle ..... 4. *bergmani*
6. Lateral apical processes each strongly angled at base, pointing postero-laterally 5. *expanda*
   Lateral apical processes straight, pointing upward ..... 7
7. Median pair of processes fused for two-thirds of their length; forewing blackish along commissure ..... 10. *pseudocommissuralis*
   Median pair of processes fused near base only; forewing wholly pale ..... 8
8. Dorsal branch of each median process strongly curved upward ..... 7. *plebeja*
   Dorsal branch of each median process curved downward or almost straight ..... 9
9. Dorsal branch of each median process longer than the ventral branch and curved downward near its apex ..... 6. *kemneri*
   Dorsal branch of each median process shorter than the ventral branch and slightly curved upward, almost straight ..... 8. *prunicola*
10. Shaft of aedoeagus bilaterally compressed toward anterior margin so as to be broad in lateral view; lateral apical processes more or less at right angles to shaft in lateral view ..... 2. *rosae*
    Aedoeagus not as above, more slender in lateral view; lateral apical processes more or less in line with shaft in lateral view ..... 11
11. Forewing darkened along commissure; median apical processes of aedoeagus usually not sharply directed downward ..... 12. *commissuralis*
    Forewing not darkened along commissure; median apical processes of aedoeagus sharply directed downward ..... 12
12. Median apical processes more than half as long as the upturned section of the aedoeagal shaft ..... 11. *dejecta*
    Median apical processes less than half as long as the upturned section of the shaft ..... 13. *euphrante*

1. *Edwardsiana alcorni* Christ. (Figs. 225, 991).—Length: 3.75-4.25 mm. Light yellow or whitish, without dark markings. The aedoeagus is distinctive. The second pair of apical processes are reduced to minute projections visible only at high magnifications.

Southern British Columbia, in mountain districts, Yukon, and Northwest Territories.

2. *Edwardsiana rosae* (L.) (*pteridis* Dahl., *lactea* Doug.), the rose leafhopper, cicadelle du rosier, (Figs. 226, 992).—Length: 3.5-3.75 mm. White or whitish-yellow without darker markings. The aedoeagus is distinctive.

Southern British Columbia, southern Ontario, southern Quebec, and Nova Scotia, widely distributed and locally abundant. Host plants: apple, rose, plum, and *Rubus* spp.

3. *Edwardsiana lethierryi* (Edw.).—Length: 3.5-3.75 mm. Yellowish-white or light yellow without dark markings. The aedoeagus is distinctive.

Recorded from southern Ontario and Nova Scotia. Host plant: maple.

4. *Edwardsiana bergmani* (Tull.) subsp. *ariadne* (McA.) (Figs. 227, 993).—Length: 3.75-4.25 mm. Pale yellow or pale orange-yellow without dark markings. The aedoeagus is distinctive.

Alaska, British Columbia, Yukon (up to 2,600 feet), Boreal Region of Quebec, and Labrador.

5. *Edwardsiana expanda* (DeL. & Johns.) (Figs. 228, 994).—Length: 4.0-4.5 mm. White or greenish-white without dark markings. The aedoeagus is distinctive.

Alaska.

6. *Edwardsiana kennneri* Oss. (Figs. 229, 995).—Length: 4.0-4.5 mm. Whitish without dark markings. The aedoeagus is distinctive.

Yukon and Northwest Territories.

7. *Edwardsiana plebeja* (Edw.) (*divergens* Rib.) (Figs. 230, 996).—Length: 3.25-3.75 mm. Pale yellow or yellowish-white without dark markings. The aedoeagus is distinctive.

Southern Ontario, probably introduced from Europe. Host plant: elm.

8. *Edwardsiana prunicola* (Edw.) (*barbata* Rib., *pruni* DeL. & Dav., *pruinella* DeL.) (Figs. 231, 997).—Length: 3.75-4.0 mm. Yellowish-white or pale yellow without dark markings. The aedoeagus is distinctive.

Southern British Columbia and southern Ontario, probably introduced from Europe.

9. *Edwardsiana australis* (Frogg.) (*froggatti* Bak., *xanthippe* McA., *malini* DeL., *oxyacanthae* Rib.) (Figs. 232, 998).—Length: 3.5-3.75 mm. Pale yellow or pale orange-yellow, the forewing often smoky on the commissure in the posterior half of the clavus, at the apices of the basal cells, and in the apical cells, and sometimes with a dark brown band from the scutellum to the apex of the clavus. The aedoeagus is distinctive.

Southern British Columbia and southern Ontario. Host plants: apple, plum, and hawthorn.

10. *Edwardsiana pseudocommissuralis* Christ. (Figs. 233, 999).—Length: 3.75-4.0 mm. Pale yellow with the scutellum brown except the basal triangles; the forewing with a black band along the commissure and with the apices of the basal cells and the apical cells smoky. The aedoeagus is distinctive.

Boreal Region of Quebec.

11. *Edwardsiana dejecta* Christ. (Figs. 234, 1000).—Length: 4.0-4.5 mm. Yellowish-white or pale yellow without dark markings. The aedoeagus is distinctive.

Southern Ontario. Host plant: dogwood.

12. *Edwardsiana commissuralis* (Stal) (Figs. 235, 1001).—Length: 3.0-3.5 mm. Yellowish-white or pale yellow with the scutellum and the commissural margin of the forewing dark brown or blackish. The pronotum often is dark brown or blackish and the clavus largely dark; the forewings are sometimes wholly hyaline dark brownish, with an intensification of the dark colour in the claval and costal regions; and sometimes the species is entirely pale or has only the scutellum darkened. The aedoeagus is distinctive. According to Christian (1953), this species, *euphrante*, and four species that have not been found in Canada form a species-group in which the specific characters intergrade.

Alaska, British Columbia (up to 3700 ft.), Yukon, and Northwest Territories, widely distributed.

13. *Edwardsiana euphrante* (McA.) (Figs. 236, 1002).—Length: 3.5 mm. Yellowish-white or yellow, the forewings sometimes tinged with greenish, and with the apices of the basal cells and the apical cells slightly smoky. The aedoeagus is distinctive.

Southern British Columbia and southern Alberta.

**Genus 8. *Empoasca* Walsh (*Kybos* Fieb., *Cybus* Doug., *Hebeta* DeL.)**

A large and taxonomically difficult genus. Published descriptions and figures are often inadequate for reliable specific identifications. Because of this the following list is incomplete; it is not possible to name some of the species known to occur in Canada and others are still undescribed. Moreover, because of the small size of the insects they are often overlooked by collectors. For these reasons, a reliable key to the Canadian species cannot be prepared at present. Specific distinctions in the genus are largely in characters of the internal male genitalia. The structures that exhibit the best distinctions are the hook or spine that extends downward from either side of the tenth, or anal, segment, the process that extends backward from the lower margin by the pygofer, and the style. In some species of the *confusa* group the aedoeagus shows good specific characters, and in the *smaragdula* group there are good specific characters in the form of the anterior abdominal sclerites; these structures are illustrated when necessary. Females of species of *Empoasca* usually are impossible to name in the absence of associated males. At time of writing the genus is under revision by D. A. Young.

**Key to species groups of *Empoasca***

1. Vertex relatively long, distinctly bluntly pointed, not broad; small, slender, usually pale greenish species; nymphs mostly on herbaceous plants ..... 1. *fabae* group
   Vertex short and broad, not pointed; usually large, robust, and often strongly-coloured or iridescent species; nymphs usually on woody plants ..... 2
2. Style with conspicuous long fine hairs and with its apical portion long and curved; anal hooks usually long and sickle-shaped; forewing with at least one apical vein arising from outer basal cell; nymphs usually on *Salix* and *Populus* spp. ..... 19. *smaragdula* group
   Style not with such hairs and with apical region straight or almost so; anal hooks various, often short and stout; forewing with all apical veins arising from central basal cell; nymphs usually on other woody plants ..... 12. *confusa* group

1. *Empoasca fabae* (Harr.) (*mali* LeB., *consobrina* Walsh, *malefica* Walsh, *viridescens* Walsh, *albopicta* Forbes), the potato leafhopper, cicadelle de la pomme de terre, (Figs. 237, 611, 1003).—Length: 3.0-3.5 mm. Light green or yellowish-green, occasionally with darker or paler spots on the vertex and paler spots near the anterior margin of the pronotum and on the scutellum. The species can be identified reliably only by examination of the internal male genitalia; external specific characters and specific characters in the female have yet to be found. The distinctive feature is the shape of the pygofer process, in conjunction with the shape of the anal hooks and of the style. The pygofer process is thickened on its basal half and has the apical third curved and the apical margin obliquely truncate. These structures are distinctive for the species, though there is some variation.

Widely distributed and frequently very common in the southern parts of Manitoba, Ontario, and Quebec, and found also in southern Saskatchewan, New Brunswick, Nova Scotia, and Prince Edward Island. The species has been recorded from most of the provinces, except Labrador, Northwest Territories, and Yukon, but many of these records are not reliable as identifications apparently were made largely on a basis of external characters only. Some

records from eastern Canada may refer to other species, notably *erigeron*, and all records from Alberta and British Columbia, and many from Saskatchewan, refer to other species, most of them probably to *filamenta*. The species appears to be relatively rare west of Manitoba and there are no reliable records from localities west of Saskatoon. In the East it is often so abundant as to cause serious damage, particularly in southern Ontario where it is often an important pest of potato and beans. It feeds and develops on a variety of kinds of vegetables, on alfalfa and clover, on some ornamental plants such as dahlia, on apple and other fruit trees, and on wild hosts. There are well over 100 species of known host plants. Damage is caused by the insects feeding and is directly proportional to the number of specimens present. The species is especially injurious in that it feeds on the phloem tissues, or xylem vessels, rather than on the mesophyll tissue. The feeding causes distortion of the leaf veins so that the leaf curls upward and rolls inward from the edges, the foliage is disfigured, the tips and margins of the leaves turn yellow, and the growth of the plant is stunted. The injury is commonly known as hopperburn, tip-burn, or leafhopper yellowing. Severe attack can cause partial, or even total, destruction of the plant. The species is not known to survive the winter in Canada. It migrates northward from the southern States in the spring and reaches Canada usually about the middle or end of June, though it has been found early in May. Up to three, and possibly four, partial or complete generations develop during the summer. Weather, climate, and altitude are important in regulating the distributions and abundance. The species is most abundant in low altitude areas and in relatively humid regions or seasons. Several inches of rain during the growing season apparently are necessary if the species is to increase sufficiently to cause significant economic damage.

2. *Empoasca filamenta* DeL. (Figs. 238, 610, 1004).—Length: 3.0-3.5 mm. Light green or yellowish-green, often with paler markings on the vertex, near the anterior margin of the pronotum, and on the scutellum. The internal male genitalia are distinctive and must be examined for reliable identifications. Distinctive features are the relatively long, stout, irregularly tapering anal hook and the pygofer process which is rather similar to that of *fabae* but has the apical third more slender and more evenly tapered to a point at its apex. The var. *abbreviata* DeL., which occurs in southern British Columbia, has the pygofer process relatively shorter than that of the typical form.

This species replaces *fabae* in the West as the dominant species of *Empoasca* on field crops. It tends to be most common in regions or at times of low rainfall and low relative humidity, in shady situations, and at relatively high altitudes. It is widely distributed and often abundant in the southern parts of British Columbia and Alberta and has also been found in Yukon, Northwest Territories, Saskatchewan, and Manitoba. There is a variety of host plants, of which potato, beans, and alfalfa are among the most important. The species feeds on the mesophyll tissue, unlike *fabae;* this produces a stippling of the upper surface of the leaves.

3. *Empoasca cerea* DeL. (Figs. 239, 1005).—Length: 3.0 mm. Light green or yellowish-green, often with paler markings on the vertex and pronotum; forewings hyaline greenish or yellowish-green with the veins darker. The genitalic characters, notably the form of the anal hook, are distinctive.

Southern Ontario.

4. *Empoasca convergens* DeL. & Dav. (Figs. 240, 1006).—Length: 3.5 mm. Pale yellowish-green without darker markings; or, yellowish with the pronotum

largely brown and the forewings brown on the basal two-thirds except for a pale area at the middle of the costal region, with a hyaline transverse band at the apex of the clavus, and with the apical region either hyaline or infuscated. The genitalic characters, notably the form of the anal hook and of the pygofer process, are distinctive.

Alaska, British Columbia, Yukon, and Ontario.

5. *Empoasca bifurcata* DeL. (Figs. 241, 1007).—Length: 3.0-3.5 mm. Rather light green with the head yellowish. The genitalic characters, notably the bifurcate anal hook and the long, irregularly sinuate pygofer process, are distinctive.

Southern Ontario and southern Quebec. There is a considerable number of known host plants but the species is not apparently of economic importance in Canada.

6. *Empoasca erigeron* DeL. (Figs. 242, 1008).—Length: 3.0-3.5 mm. Light green or yellowish-green, often with whitish markings on the vertex, near the anterior margin of the pronotum, and on the scutellum. The anal hook and the pygofer process are distinctive. Examination of these structures is necessary to distinguish the species from *fabae*, which it otherwise resembles closely.

Widely distributed and often abundant in southern Ontario and southern Quebec. It is known to feed on a variety of kinds of plants. Unlike *fabae*, it feeds on the mesophyll tissues, which produces stippling of the leaves.

7. *Empoasca coccinea* (Fitch) (Figs. 243, 1009).—Length: 3:0-3.5 mm. Bright red, or dark green suffused with red; forewings smoky, sometimes tinged with reddish. The red colour, when present, and the pygofer processes are distinctive.

Mountains of Alberta, southern Ontario, and probably throughout the Boreal Region. Host plant: pine.

8. *Empoasca neaspersa* Oman & Wheel. (Figs. 244, 1010).—Length: 2.5-3.0 mm. Pale whitish-green; vertex with faint, orange markings; forewings closely covered with irregular, pale brownish spots, and with the apical cells and the apices of the basal and brachial cells margined with pale brownish. The pygofer process, in conjunction with the anal hook, is distinctive.

Dry areas of southern British Columbia. Host plants: sagebrush and probably *Bigelovia* sp.

9. *Empoasca nigra* Gill. & Bak. (*nigroscuta* Gill. & Bak., *pulchella* Gill. & Bak., *typhlocyboides* Gill. & Bak., *robusta* Gill.) (Figs. 245, 1011).—Length: 2.75-3.0 mm. The typical form is black with the ocelli pale-margined and the forewing becoming smoky toward its apex. Var. *nigroscuta* (Fig. 245) is pale yellowish or pale greenish-yellow with the markings of the pronotum and scutellum black and those of the forewing dark brown or brown. Var. *pulchella* is pale yellowish or greenish-yellow with orange markings on the pronotum and scutellum and with three smoky transverse bands on the forewings. Var. *typhlocyboides* is pale whitish-green or pale yellowish-green with orange longitudinal markings on the pronotum and scutellum and with the forewing smoky-tinged toward the apex. Var. *robusta* is pale yellowish-white with longitudinal yellow lines on the pronotum and forewings. The anal hook and the pygofer process are distinctive features of the species.

Widely distributed and locally common in dry areas in southern British Columbia. Host plant: sagebrush.

10. *Empoasca elongata* DeL. (Figs. 246, 1012).—Length: 3.5-3.75 mm.

Pale green or yellowish-green; forewings hyaline, greenish or yellowish along the veins. The anal hook and pygofer process are distinctive.

Widely distributed in southern British Columbia.

11. *Empoasca* sp. near *panda* DeL. (Figs. 247, 1013).—Length: 3.5 mm. Yellowish, becoming brownish on the disc of the pronotum and between the veins of the forewing, dark brown on the costal area near base and beyond middle, and narrowly dark brown at the commissure, and forewing whitish at the middle of the costal area and in the region of the apex of the clavus. The anal hook and pygofer process are distinctive. This species may be *panda*, though there are some differences between it and the original description. There is a possibility that *panda*, which was described from southwestern British Columbia, is a variable species of which this is a variety.

Widely distributed in British Columbia.

12. *Empoasca alboneura* Gill. (Figs. 248, 1014).—Length: 3.0 mm. Dull greenish, with paler markings on the vertex and pronotum and with the veins of the forewing pale. These pale veins are rather distinctive. The genitalic characters, notably the anal hook, are distinctive.

Southern British Columbia.

13. *Empoasca vincula* DeL. (Figs. 249, 1022).—Length: 3.5-3.75 mm. Greenish or yellowish-green, the forewing suffused with brown at base of clavus and in apical region and with an irregular brown transverse band at middle. These brown areas vary in extent. The genitalic characters, notably the anal hook, are distinctive.

Southern Saskatchewan and southern Manitoba.

14. *Empoasca confusa* DeL. & Dav. (Figs. 250, 606, 1015).—Length: 3.0-3.75 mm. Green, yellowish-green, or greenish-yellow, usually with the forewings tinged with brownish in the apical cells and often with a small brown spot near the apex of the inner basal cell. Distinctive features are the short and stout anal hook, the long and almost straight apical region of the style, and the stout pygofer processes that cross each other near their apices in ventral view.

Widely distributed and locally abundant in the southern parts of British Columbia, Ontario, and Quebec, and found in Prince Edward Island. Host plants: sweet bay, sweet fern, and probably other plants.

15. *Empoasca atrolabes* Gill. (Figs. 251, 607, 1016).—Length: 3.5 mm. Rather bright green or brownish-green, the forewing with the apical cells and the apices of the basal cells brownish and with a fuscous spot near the apex of the inner basal cell. The genitalic characters are distinctive; the aedoeagus has a long arm extending posteriorly from near the base of the shaft.

British Columbia, Northwest Territories, southern Manitoba, southern Ontario, southern Quebec, New Brunswick, and Labrador.

16. *Empoasca maligna* (Walsh) (*unicolor* Gill.), the apple leafhopper, cicadelle du pommier, (Figs. 252, 609, 1017).—Length: 3.5-3.75 mm. Light green or yellowish-green, the forewing tinged smoky at apex. The genitalic characters are distinctive.

Widely distributed and locally abundant in the southern parts of Manitoba, Ontario, and Quebec, and in New Brunswick. Host plant: apple.

17. *Empoasca bipunctata* (Osh.) (Figs. 253, 1018).—Length: 3.5-4.0 mm. Light green; forewing usually tinged with smoky in the apical cells and with a fuscous spot near the apex of the inner basal cell. The anal hook and pygofer process are distinctive.

Southern Alberta and southern Ontario. Host plant: Chinese elm.

18. *Empoasca denticula* Gill. (Figs. 254, 1019).—Length: 3.5-3.75 mm. Green or yellowish-green, the forewing becoming hyaline toward the apical region. The genitalic characters are distinctive.

Southern Ontario. Host plant: probably sweet fern.

19. *Empoasca apata* DeL. & Dav. (Figs. 255, 1020).—Length: 3.75-4.0 mm. Green, the forewing usually with the apical cells smoky-tinged and with a fuscous spot near the apex of the inner basal cell. Occasionally the vertex is suffused with dark brown or fuscous at the sides and the pronotum and scutellum are tinged brownish. The genitalic characters are distinctive.

Northern Manitoba. Host plant: probably birch.

20. *Empoasca unica* Prov. (*splendida* Gill.) (Figs. 256, 1021).—Length: 3.5-3.75 mm. Green, the vertex becoming yellow anteriorly and the pronotum and scutellum largely brownish-yellow; forewing brownish-yellow or yellowish-green with the veins green, the apical cells smoky, and a blackish spot near the apex of the inner basal cell. The genitalic characters are distinctive.

Southern Quebec and New Brunswick. Host plant: probably alder.

21. *Empoasca smaragdula* (Fall.) (*viridipes* Curt.) (Figs. 257, 612, 1023). —Length: 4.0-4.5 mm. Light brownish-green, usually with a coppery tinge, but sometimes largely or wholly greenish. The genitalic characters are distinctive.

Southern Ontario. Host plant: probably birch.

22. *Empoasca clypeata* Gill. & Bak. (Figs. 258, 1024).—Length: 4.5-5.0 mm. Yellowish-brown, greenish-yellow, or dull green, the forewing often dark brown along the commissure and claval suture and fuscous in the apical cells. Sometimes the pronotum, scutellum, clavus, and apical cells are largely dark brown, or even fuscous. The genitalic characters are distinctive. The var. *annella* Hartz., which occurs in Yukon, differs from the typical form primarily in having the apical region of the pygofer process irregularly sinuate. The dark varieties apparently have been confused with *smaragdula*.

Generally distributed and locally common in the West. Alaska, British Columbia, Yukon, Northwest Territories, mountains of Alberta, southern Saskatchewan, and southern Ontario. Host plants: *Salix* spp.

23. *Empoasca patula* DeL. (Figs. 259, 1025).—Length: 4.0-4.5 mm. Yellowish-green or greenish with a yellow tinge on the scutellum. The genitalic characters, notably the pygofer process, are distinctive. The species is represented in Canada by the var. *magna* DeL., which is larger than the typical form.

Widely distributed in the southern parts of British Columbia, Saskatchewan, Manitoba, Ontario, and Quebec.

24. *Empoasca copula* DeL. (Figs. 260, 1026).—Length: 3.5-4.0 mm. Yellowish, greenish-yellow, or pale brownish-yellow. The genitalic characters are distinctive.

Southern Ontario and southern Quebec.

25. *Empoasca incida* DeL.(Figs. 261, 1027).—Length: 4.0-4.5 mm. Greenish-yellow, yellowish-green, or yellowish. The genitalic characters are distinctive.

Widely distributed in southern British Columbia. Host plants: probably *Salix* spp.

26. *Empoasca aureoviridis* (Uhl.) (*vittata* Hartz., *hartzelli* Bak.) (Figs. 262, 1028).—Length: 4.5-5.0 mm. Green, frequently with the basal triangles

of the scutellum reddish; or yellow or yellowish-green with the vertex largely red, the pronotum often suffused with red to a variable extent, and the basal triangles of the scutellum red. The genitalic characters are distinctive.

Southern British Columbia.

### Subfamily Deltocephalinae

A large group of small or moderate-sized insects. Many species can be named reliably only on a basis of genitalic characters; the genitalia of both sexes usually exhibit specific characters. A considerable number of the species have grasses or sedges as host plants. The subfamily, or major parts of it, was revised by DeLong (1926), Sleesman (1929), and DeLong and Sleesman (1929), but many additional species have been subsequently described.

### Key to tribes of Deltocephalinae

1. Genae visible from above behind the eyes ..... Scaphytopiini
   Genae not visible from above ..... 2
2. Commissural margin of forewing nearly straight from apex of scutellum to apex of wing ..... Acinopterini
   Commissural margin of forewing not straight from apex of scutellum to apex of wing, or species brachypterous ..... 3
3. Forewing long and slender with outer anteapical cell absent, inner anteapical open basally, appendix well developed, and without extra crossveins ..... 4
   Macropterous with venation not as above, or subbrachypterous or brachypterous ..... Deltocephalini
4. Head usually very short; basal segment of hind tarsus distinctly grooved at base ..... Balcluthini
   Head not very short; basal segment of hind tarsus not grooved at base ..... Macrostelini

### Tribe Scaphytopiini

#### Genus *Scaphytopius* Ball (*Tumeus* DeL., *Hebenarius* DeL.), subgenus *Cloanthanus* Ball.

Members of this genus can be recognized by the long, pointed vertex and by the genae being visible from above. Relatively few of the known North American species occur in Canada. Specific distinctions are largely in characters of the internal male genitalia. The aedoeagus is small and there is only a membranous connection between it and a pair of large processes, or paraphyses, that articulate with the connective and that usually show the best specific characters. The North American species were revised by Hepner (1946) and Canadian species by Beirne (1953).

### Key to species of *Scaphytopius (Cloanthanus)*

1. Aedoeagus with a pointed, downwardly-directed, spine-like process at either side in ventral view; general colour whitish with black markings ..... 5. *diabolus*
   Aedoeagus without such projections; general colour not as above ..... 2
2. Forewings blackish; paraphyses slender, not expanded toward apices ..... 2. *frontalis*
   Forewings usually not blackish, but if blackish then paraphyses each broadly expanded on apical third ..... 3
3. Paraphyses long and slender, not or only slightly expanded, not twisted around shaft of aedoeagus ..... 4
   Paraphyses each expanded and flattened beyond middle, or twisted around shaft of aedoeagus, or both ..... 6
4. Paraphyses strongly recurved on apical third; shaft of aedoeagus relatively short; distinctly narrowed toward apex in lateral view; pygofer without excavation on ventral margin ..... 5
   Paraphyses not strongly recurved; shaft of aedoeagus longer, distinctly narrowed toward apex in lateral view; pygofer with rounded excavation in ventral margin ..... 1. *acutus*
5. Paraphyses each bifid at apex ..... 4. *sarissus*
   Paraphyses each sharply pointed at apex, not bifid ..... 3. *cinnamoneus*

6. Paraphyses each with a broad lateral projection beyond middle ..... 5. *magadalensis*
Paraphyses not as above ..... 7
7. General colour pale greenish-fulvous; paraphyses less broadly expanded toward apex, twisted around aedoeagus; aedoeagus not narrowed toward apex in ventral view ..... 6. *angustatus*
General colour not as above; paraphyses each broadly expanded toward apex; aedoeagus narrowed toward apex in ventral view ..... 8
8. Dorsal surface fulvous; vertex less than one and one-half times as long as its width between the eyes; length: 5.5-6.0 mm. ..... 9. *oregonensis*
Colour and vertex not as above; length: 5.5 mm. or less ..... 9
9. Paraphyses stout, each with a large, flattened, triangular expansion near apex ..... 10. *latus*
Paraphyses longer and more slender, each with the expansion near apex less broad and not triangular ..... 7. *argutus*

1. *Scaphytopius* (*Cloanthanus*) *acutus* (Say) (*modestus* Stal, *filamentus* DeL., *tenuis* DeL.) (Figs. 265, 613, 1029).—Length: 4.0-5.0 mm. Vertex and thorax light ochreous, marked and closely irrorated with light brown, brown, or fuscous; forewings ochreous, irrorated with brown or fuscous, with numerous large, rounded, whitish areas in the cells and costal region. There is variation in the amount, shade, and intensity of the dark markings, so that the general colour varies from brownish-ochreous to brownish-fuscous. There is also variation in the length of the vertex: most specimens from British Columbia have the vertex about twice as long as its width between the eyes, whereas further east the vertex is usually about one and one-half times as long as its width between the eyes. The two forms intergrade. The form with the relatively long vertex has often been confused with, and identified as, *S.* (*C.*) *dubius* Van D., which is a distinct species that apparently has not been found in Canada. The internal male genitalia of *acutus* are distinctive, though there is some geographical variation.

A common and widely distributed species. Alaska, British Columbia (up to 4500 feet), Northwest Territories, the southern and Boreal regions of Alberta, Saskatchewan, Manitoba, Ontario, and Quebec, and Nova Scotia, and Prince Edward Island. Host plants: probably various herbaceous plants. It is a vector of western X-disease of peach and cherry.

2. *Scaphytopius* (*Cloanthanus*) *frontalis* (Van D.) (Figs. 271, 614, 1030).—Length: 3.5-4.5 mm. Vertex and thorax pale yellow, heavily marked with deep fuscous-brown so as to appear largely dark; forewing ochreous, closely irrorated with deep fuscous-brown so as to appear largely that colour, with diagonal whitish areas in the costal region and small, rounded, whitish areas in the cells. The form of the aedoeagus in lateral view readily distinguishes this species from *acutus* and *cinnamoneus*, which also have slender paraphyses.

Locally common in southern Ontario.

3. *Scaphytopius* (*Cloanthanus*) *cinnamoneus* (Osb.) (Figs. 264, 1031).—Length: 4.5 mm. Vertex and thorax light ochreous with the markings brown; forewings pale ochreous-yellow, irrorated with dark brown and with rounded, whitish areas in the cells and costal region. This species is normally less heavily dark-marked than the two species discussed above. The genitalia are distinctive.

Southern Manitoba and southern Quebec.

4. *Scaphytopius* (*Cloanthanus*) *sarissus* Beir. (Figs. 269, 615, 1032).—Length: 4.0-5.0 mm. Vertex and thorax light ochreous, closely marked with brown or light brown so as to appear largely those colours; forewings yellowish-ochreous with the veins and markings brown or fuscous-brown and with rounded, whitish areas in the cells and costal region. The forked apex of the paraphysis is distinctive; otherwise the species closely resembles *cinnamoneus*.

Southern Ontario and Nova Scotia, apparently common in acid bogs.

5. *Scaphytopius* (*Cloanthanus*) *diabolus* Van D. (Figs. 270, 1033).—Length: 4.0-4.5 mm. Vertex and thorax pale ochreous with the markings black; forewings whitish or greyish-white with the markings blackish-fuscous. The markings give the insect a distinctly banded appearance that is rather distinctive.

Dry areas of southern British Columbia. Host plant: possibly *Purshia* sp.

6. *Scaphytopius* (*Cloanthanus*) *angustatus* (Osb.) (Figs. 272, 1034).—Length: 4.5 mm. Ochreous-yellow with the markings ochreous-brown, the veins in the costal and apical regions of the forewings dark brown, and with rounded whitish areas in the cells and costal region. The male genitalia are distinctive.

Southern Ontario.

7. *Scaphytopius* (*Cloanthanus*) *argutus* DeL. (*hastus* DeL., *lanceus* DeL.) (Figs. 263, 1035).—Length: 5.0 mm. Yellowish-ochreous with the markings brown or dark brown, the basal triangles of the scutellum light reddish-brown and the forewings with whitish areas in the cells and costal region. The male genitalia are distinctive.

Southern Quebec.

8. *Scaphytopius* (*Cloanthanus*) *magdalensis* (Prov.) (*obscurus* Osb., *carolinus* Lath., *vaccinii* DeL.) (Figs. 268, 1036).—Length: 3.75-4.5 mm. Ochreous-yellow with the markings dark brown; forewings with rounded, whitish areas in the cells and apical region. The male genitalia are distinctive.

Widely distributed in southern Ontario and southern Quebec. Host plant: blueberry. It is a vector of blueberry stunt.

9. *Scaphytopius* (*Cloanthanus*) *oregonensis* (Bak.) (Figs. 266, 1037.—Length: 5.5 mm. Almost wholly brown, the ochreous ground colour visible only as small areas at and near the apex of the vertex and at the sides of the scutellum; forewing with the veins of the costal and apical regions dark brown, with rounded, whitish areas in the costal region and the cells, and with variable dark brown irrorations in the cells. The male genitalia are distinctive.

Southern British Columbia.

10. *Scaphytopius* (*Cloanthanus*) *latus* (Bak.) (*cuprescens* Osb.) (Figs. 267, 1038).—Length: 4.5-5.0 mm. Yellowish-ochreous with the markings darker ochreous, brown, or fuscous; forewings with the veins of the costal region dark brown and with rounded, whitish areas in the cells and costal region. There is much variation: the general colour varies from dull ochreous to blackish-fuscous. The male genitalia are distinctive.

Widely distributed in the southern parts of British Columbia, Alberta, Saskatchewan, Manitoba, Ontario, and Quebec.

### Tribe Acinopterini

### Genus *Acinopterus* Van D.

Specific characters in this genus are primarily in the internal male genitalia. The North American species were revised by Beamer and Lawson (1938).

*Acinopterus viridis* Ball (*variegatus* Ball, *pallidus* Laws., *elongatus* Laws., *latus* Laws.) (Figs. 273, 616, 1039).—Length: 4.5-5.5 mm. Light green; forewing with the veins darker green except in the apical region where they are yellowish-green, and with small, brownish markings at the commissural ends of the claval veins and sometimes in the inner apical cell. The general appearance of this species and the male genitalia are distinctive.

Grassland areas of southern British Columbia, southern Alberta, and southern Ontario. Host plants: grasses and herbaceous plants.

## Tribe Balcluthini

### Key to genera of Balcluthini

Head narrower than pronotum ..... *Balclutha*
Head wider than pronotum ..... *Nesosteles*

### Genus *Nesosteles* Kirk.

*Nesosteles neglectus* (DeL. & Dav.) (*pallidus* DeL. & Dav., *pallidens* DeL.) (Figs. 274, 617, 1040).—Length: 3.0-3.25 mm. Pale ochreous with the forewings hyaline whitish-ochreous. There are sometimes light brownish markings on the vertex, pronotum, and scutellum. The aedoeagus is distinctive.

Widely distributed in the southern parts of British Columbia, Alberta, Saskatchewan, Manitoba, and Ontario, in grassland areas.

### Genus *Balclutha* Kirk. (*Gnathodus* Fieb., *Eugnathodus* Bak.)

Species of this genus resemble one another in external characters and are variable in colour and markings. They can be named reliably only by examination of the internal male genitalia. The Canadian species were discussed by Beirne (1950).

### Key to species of *Balclutha*

1. Apical portion of aedoeagus long and slender, more than one and one-half times as long as the expanded basal portion ..... 2
   Apical portion of aedoeagus shorter, more tapering, barely as long as the expanded basal portion ..... 1. *punctata*
2. Smaller species, 3.75-4.0 mm. long; basal portion of aedoeagus tapered posteriorly in lateral view ..... 2. *impicta*
   Larger species, 4.5-50 mm. long; basal portion of aedoeagus rounded and expanded posteriorly in lateral view ..... 3. *arctica*

1. *Balclutha punctata* (Thunb.) (*rosea* Prov., *jacosa* Prov., *confusa* Gill. & Bak., *manitou* Gill. & Bak., *vernalis* Van D.) (Figs. 275, 618, 1041).—Length: 3.5-4.5 mm. Usually light green or ochreous without darker markings; often with a pair of brownish or reddish spots on the vertex, indications of brownish longitudinal stripes on the pronotum, and the basal triangles of the scutellum brown; sometimes with scattered dark brown spots on the forewings. The subsp. *manitou* is larger than the common form and has the vertex more distinctly angled. It occurs in parts of British Columbia and Northwest Territories. The form of the aedoeagus is the distinctive feature of the species.

A very common species with a distribution that covers the greater part of Canada to the tree line. Alaska, British Columbia (up to 5,400 feet), Yukon, Northwest Territories, Alberta, Saskatchewan, Manitoba, Ontario, Quebec, New Brunswick, Prince Edward Island, Newfoundland, and Labrador. It occurs in grasslands and among herbaceous plants.

2. *Balclutha impicta* (Van D.) (*flava* Bak., *media* Bak., *viridis* Osb., *maculata* Dav. & DeL.) (Figs. 276, 1042).—Length: 3.75-4.0 mm. Light green or ochreous, either without dark markings or with red or brownish spots on the vertex and near the anterior margin of the pronotum, indications of longitudinal brown bands on the pronotum, and brown spots on the forewings. This species can be distinguished reliably from *punctata* only by characters of the internal male genitalia.

Southern British Columbia, southern Alberta, northern and southern Manitoba, southern Ontario, southern Quebec, and Prince Edward Island. Widely distributed but local.

3. *Balclutha arctica* Beir. (Figs. 277, 1043).—Length: 4.5-5.0 mm. Light greenish or greenish-yellow without definite dark markings. A larger species than its allies, with distinctive aedoeagus.

Alaska, British Columbia, Yukon, and Northwest Territories.

## Tribe Macrostelini

### Genus *Macrosteles* Fieb.

Members of this genus often show much individual and geographical variation in colour and markings, and sometimes in size and form. The internal male genitalia must be examined for reliable identifications. Females often cannot be named in the absence of associated males. The North American species were revised by Beirne (1952).

#### Key to subgenera of *Macrosteles*

1. Mid-line of face dark, if pale then face wholly pale or other dark markings only feebly indicated; vertex usually with four pairs of spots, the median pair usually linear and never large and rounded, but if absent then the posterior pair are either large or absent or rudimentary; pygofer with a small, digitate process on posterior margin ..... *Macrosteles*
   Mid-line of face pale and bordered at each side by a dark band, or face wholly pale; vertex with five pairs of spots, the median pair large and rounded, the remainder usually reduced or absent; pygofer without digitate process on posterior margin ..... 2
2. Front margin of head, viewed from above, evenly curved from middle to sides of eyes, the eyes not obviously protruding; side margins of pronotum short; more slender species; pygofer with a weak notch in posterior margin ..... *Sonronius*
   Front margin of head, viewed from above, with the eyes distinctly protruding beyond the margin of the vertex next to them; side margins of pronotum longer; more robust species; male pygofer without a notch in posterior margin ..... *Davisonia*

#### Key to species of *Macrosteles (Davisonia)*

1. Pronotum with a large, brown patch at each side of mid-line; scutellum with black basal triangles ..... 1. *americana*
   Pronotum without such brown patches; scutellum usually wholly pale but sometimes with brown basal triangles ..... 2
2. Larger species, 5.5-7.5 mm. long; forewing more or less streaked with brown between the veins, seventh sternum of female with a median, longitudinal, raised ridge ... 2. *major*
   Smaller species, 4.0-5.5 mm. long; forewing tinged fuscous between the veins; female seventh sternum without raised ridge ..... 3. *snowi*

1. *Macrosteles* (*Davisonia*) *americana* (Van D.) (*delongi* Dorst) (Figs. 278, 619, 1044).—Length: 4.5-5.0 mm. Tawny yellow with the large spots of the vertex and scutellum black and the remaining dark markings brown. The brown areas on the pronotum and the genitalic characters are distinctive.

Southern Ontario and southern Quebec. Host plants: *Salix* spp.

2. *Macrosteles* (*Davisonia*) *major* (Dorst) (Figs. 279, 620, 1045).—Length: 5.5-7.5 mm. Tawny yellow with the large spots of the vertex and scutellum black, the markings of the forewings greyish or brown, and the other dark markings brown. The large size and the genitalic characters are distinctive.

Southern parts of Alberta, Saskatchewan, Manitoba, and Ontario. Host plants: *Salix* spp.

3. *Macrosteles* (*Davisonia*) *snowi* (Dorst) (Figs. 280, 621, 1046).—Length: 4.0-5.5 mm. Greenish-yellow with the large spots of the vertex black and the other dark markings brown. There is variation in the extent of the dark markings. The genitalic characters are distinctive.

Southern Saskatchewan and southern Manitoba. Host plants: *Salix* spp.

#### Key to species of *Macrosteles (Sonronius)*

Veins of forewing, at least in male, partly or wholly brown; aedoeagus shorter, stouter, and less strongly curved ..... *dahlbomi*
Veins of forewing wholly pale; aedoeagus longer, more slender, and more strongly curved ..... *arcuata*

*Macrostels* (*Sonronius*) *arcuata* (Gill. & Bak.) (? *suffusa* Osb.) (Figs. 281, 1047).—Length: 4.0-5.0 mm. Greenish-yellow with the large spots of the

vertex black and with other dark markings, when present, brown. A form of the female that occurs occasionally has the vertex and face bright orange-red. The aedoeagus is distinctive.

This species has a mainly mountain and Boreal distribution that extends to the tree line. Alaska, British Columbia, Yukon, Northwest Territories, Alberta, Saskatchewan, Manitoba, Ontario, and Quebec.

*Macrosteles* (*Sonronius*) *dahlbomi* (Zett.) (*laetus* Uhl., *vanduzeei* Gill. & Bak., *ungae* Ashm.) (Figs. 282, 1048).—Length: 4.0-6.0 mm. Tawny yellow with the markings black or dark brown. There is much variation in the extent of the dark markings; in general, males and specimens from northern localities or high altitudes tend to be darker than females and than specimens from more southerly areas. The aedoeagus is distinctive.

A locally common species with a mountain and Boreal distribution that extends northward to the tree line. Alaska, British Columbia (up to 6,000 feet), Yukon (up to 3,200 feet), Northwest Territories, Alberta, Quebec, Newfoundland, and Labrador.

**Key to species of *Macrosteles (Macrosteles)***

1. Posterior pair of spots of vertex large and rounded; median pair either small and not linear or, usually, absent ..... 2
   Posterior spots of vertex small or absent, if moderate or large then median pair always present and linear in form ..... 3
2. Apical region of each apical process of aedoeagus flattened as a triangular expansion with a serrated edge ..... 2. *lepida*
   Apical region of each apical process not flattened, expanded, and serrated ..... 1. *variata*
3. Apical processes of aedoeagus crossing each other ..... 7
   Apical processes not crossing, but parallel or diverging ..... 4
4. Apical processes of aedoeagus each with two branches ..... 13
   Apical processes simple, not branched ..... 5
5. Apical processes of aedoeagus forming a U in ventral view ..... 10. *curvata*
   Apical processes not forming a U in ventral view, usually diverging from base ..... 6
6. Apical processes of aedoeagus very long, almost parallel in ventral view, strongly curved in lateral view ..... 12. *laevis*
   Apical processes shorter, usually diverging in ventral view, usually less strongly curved in lateral view ..... 11. *fascifrons*
7. Apical processes of aedoeagus spine-like, each curved downward near its base to lie more or less parallel to shaft or to point downward at right angles to shaft ..... 8
   Apical processes more or less flattened, not or only feebly pointing downward, never pointing anteriorly ..... 10
8. Apical processes of aedoeagus pointing downward at right angles to shaft; forewing almost uniformly blackish ..... 5. *osborni*
   Apical processes of aedoeagus pointing anteriorly and lying more or less parallel to shaft; forewing never almost uniformly blackish, usually largely pale ..... 9
9. Larger species, 5.0-5.5 mm. long; vertex twice as wide between the eyes as its median length ..... 3. *elongata*
   Smaller species, 3.0-3.5 mm. long; vertex less than twice as wide between the eyes as its median length ..... 4. *divisa*
10. Smaller species, length 3.0 mm. or less ..... 11
    Larger species, length 3.5 mm. or more ..... 12
11. Vertex pointed, one-fifth longer at middle than next the eye ..... 6. *potoria*
    Vertex rounded, hardly more than one-tenth longer at middle than next the eye ..... 7. *slossoni*
12. Vertex broadly rounded in front, at least two-sevenths longer at middle than next the eye; apical processes of aedoeagus in lateral view each with a flattened, rounded expansion near base ..... 8. *salina*
    Vertex usually more or less pointed in front, less than two-sevenths longer at middle than next the eye; apical processes not expanded at their bases ..... 9. *fieberi*
13. Vertex largely black; apical processes of aedoeagus forming a U in ventral view, with the apical region of each branched into a short, blunt, laterally directed process and a long, slender, posteriorly directed spine ..... 14. *borealis*

Vertex largely or wholly pale; each process of aedoeagus with the lateral branch at least as long as the apical ..... 13. *bifurcata*

1. *Macrosteles* (*Macrosteles*) *variata* (Fall.) (*fumatus* H.-S.) (Figs. 283, 622, 1049).—Length: 3.5-4.5 mm. Tawny yellow, yellow, or greenish-yellow, with the markings of the body black and brown and those of the forewings often yellowish-brown. Specimens vary in size, in the development of the dark markings, in the relative lengths of the apical processes and the lateral apical projections of the aedoeagus, and sometimes in the shape of the vertex. This variation is both geographical and individual, and the different forms intergrade. There is, however, the possibility that this may be a complex of closely-related species that are ill-defined morphologically. This species resembles *lepida* but may be distinguished by the form of the apical processes of the aedoeagus and by the dark markings of the forewings often forming ill-defined transverse bands that are absent in *lepida*. The aedoeagus is distinctive.

Widely distributed and locally common, mainly in damp situations. Alaska, British Columbia, Yukon, Northwest Territories, Alberta, Manitoba, Ontario, and Quebec. Host plants: jewelweed, and probably other herbaceous plants.

2. *Macrosteles* (*Macrosteles*) *lepida* (Van D.) (Figs. 284, 623, 1050).—Length: 3.2-4.0 mm. Yellow or greenish-yellow with the spots black and the forewings tinged with smoky in the basal region or throughout. The aedoeagus is distinctive.

Southern Ontario.

3. *Macrosteles* (*Macrosteles*) *elongata* Beir. (Figs. 285, 624, 1051).—Length: 5.0-5.5 mm. Greenish-yellow with the markings black and brownish. The aedoeagus, though distinctive, resembles those of *variata* and *divisa*, but *elongata* can be distinguished readily from the former species by the arrangement of the spots on the vertex and from the latter species by its larger size.

Mountain districts of southern British Columbia, and southern Ontario. Host plants: possibly grasses.

4. *Macrosteles* (*Macrosteles*) *divisa* (Uhl.) (Figs. 286, 1052).—Length: 3.0-3.5 mm. Greenish-yellow, usually heavily marked with black and brown. There is much variation, both geographical and individual, in the extent and intensity of the dark markings. The size distinguishes this species from *elongata*, the markings of the vertex distinguish it from *variata*, and the aedoeagus distinguishes it from *fascifrons* and other species. This species is not the economically important six-spotted leafhopper, which has been referred to as *M. divisa* in the past. The economically important species is *M. fascifrons;* the true *M. divisa* is of no known economic significance.

Southern Saskatchewan, in saline marshes.

5. *Macrosteles* (*Macrosteles*) *osborni* (Dorst) (Figs. 287, 1053).—Length: 4.0-5.0 mm. Almost wholly black except for a few small yellowish areas on the pronotum and scutellum. The colour is distinctive; very dark varieties of other species are less uniformly marked.

Alaska and Northwest Territories, apparently widely distributed in marshy situations.

6. *Macrosteles* (*Macrosteles*) *potoria* (Ball) (Figs. 288, 625, 1054).—Length: 2.0-2.5 mm. Pale yellowish with heavy black markings, so that the insect appears largely blackish; forewings smoky at base and brownish on commissure. The small size, the pointed head, and the form of the aedoeagus are distinctive.

Southern parts of Alberta, Saskatchewan, Manitoba, and Ontario.

7. *Macrosteles* (*Macrosteles*) *slossoni* (Van D.) (Figs. 289, 1055).—Length: 2.5-3.0 mm. Greenish-yellow with the markings black; forewings tinged with yellowish-brown or with brown streaks between the veins forming oblique, irregular, transverse bands. There is much variation in the sizes of the black areas of the vertex and pronotum. The aedoeagus is distinctive.

Southern Ontario, southern Quebec, and Nova Scotia.

8. *Macrosteles* (*Macrosteles*) *salina* (Reut.) (Figs. 290, 626, 1056).—Length: 3.5-4.0 mm. Greenish-yellow with the markings black; forewing more or less tinged with smoky and with the commissure brown. There is variation in the extent of the dark markings; those of the vertex usually are more or less confluent in the male. The relatively long, rounded vertex of the female and the aedoeagus are distinctive.

Alaska and northern British Columbia.

9. *Macrosteles* (*Macrosteles*) *fieberi* (Edw.) (Figs. 291, 1057).—Length: 3.5-4.0 mm. Greenish-yellow with the markings black; forewings sometimes tinged with brownish between the veins. The aedoeagus is distinctive. There is some geographical variation in that specimens from the West tend to have darker forewings and the shaft of the aedoeagus less strongly curved than specimens from the East.

This species appears to have a Subarctic distribution. Alaska, Yukon, northern Manitoba, and northeastern Quebec.

10. *Macrosteles* (*Macrosteles*) *curvata* Beir. (Figs. 292, 1058).—Length: 3.0-3.5 mm. Greenish-yellow marked with black and brownish. There is much variation in the size of the black spots of the vertex, some or all of which sometimes are absent. The aedoeagus is distinctive and distinguishes the species from *fascifrons* and *fieberi*, with which it occurs and from which it cannot be distinguished reliably on a basis of external characters.

Northern Manitoba, northeastern Quebec, and Labrador.

11. *Macrosteles* (*Macrosteles*) *fascifrons* (Stal) (*quadrilineata* Forbes, *pallida* Osb., *scripta* DeL., *wilburi* Dorst), the six-spotted leafhopper, (Figs. 293, 294, 627, 1059).—Length (in Canada and Alaska): 3.5-4.2 mm. Yellowish-green, or occasionally pale ochreous or greenish-fuscous, with the markings black and brownish and the forewings often partly smoky. There is much variation. Some or all of the dark markings of the vertex may be reduced or (vars. *pallida* and *wilburi*) absent; the dark markings may be enlarged and confluent; and the forewings may be wholly pale or largely dark. The variation is geographical, environmental, and individual. Specimens from damp regions and situations tend to be dark whereas specimens from dry regions and situations tend to have the dark markings reduced. There are two main geographical forms in Canada: the typical subspecies, which is dominant in the West and Northwest, has the vertex relatively long and pointed and the dark markings usually well developed; and the subsp. *quadrilineata*, which is dominant east of the Rockies, has the vertex more distinctly rounded, the dark markings of the body usually not enlarged, and the wings largely or wholly pale except in specimens from damp situations. Other forms are found outside Canada. The aedoeagus, though variable, is distinctive. It is similar to that of *cristata*, a species that has not been found in Canada but that may occur here. That species may be distinguished by the presence of a longitudinal raised ridge on the dorsal surface of the shaft.

This is one of the most common species of leafhoppers and is found among grasses and herbaceous plants throughout Canada and Alaska to the tree line.

Alaska, British Columbia (up to 5,400 feet), Yukon, Northwest Territories, Alberta, Saskatchewan, Manitoba, Ontario, Quebec, New Brunswick, Nova Scotia, Prince Edward Island, Newfoundland, and Labrador. The nymphs feed on grasses and cereals in the spring and may be so abundant as to cause appreciable direct economic damage. Late in the spring the adults migrate to herbaceous plants where two or more overlapping generations develop during the summer. In the fall they migrate back to grasses and cereals. The species is of economic importance primarily as a vector of the virus disease that causes the symptoms known as aster yellows, carrot yellows, lettuce yellows, and yellows in many kinds of plants, purple-top wilt (blue stem) and net necrosis in potato, white heart, rabbit ear, and Rio Grande disease of lettuce, and curly-top of ornamental plants.

12. *Macrosteles* (*Macrosteles*) *laevis* (Rib.) (Figs. 295, 628, 1060).—Length: 3.5-4.0 mm. Pale greenish-ochreous with the markings black or dark brown; forewings pale. The aedoeagus is distinctive. The female may be distinguished from those of *salina* and *fascifrons*, which inhabit the same region, by the form of the seventh sternum.

Alaska, apparently widely distributed in coastal marshes.

13. *Macrosteles* (*Macrosteles*) *bifurcata* Beir. (Figs. 296, 1061).—Length: 3.5-4.0 mm. Greenish-yellow with the markings black and the forewings more or less smoky between the veins. There is variation in the size of the dark markings. A rather distinctive feature is the rounded vertex which is relatively narrow between the eyes. The aedoeagus is distinctive.

Southern Ontario and southern Quebec, widely distributed in wet situations. Host plant: possibly wild rice.

14. *Macrosteles* (*Macrosteles*) *borealis* (Dorst) (Figs. 297, 1062).—Length: 3.3-4.2 mm. Yellow with heavy black markings; forewing whitish-hyaline with the markings brownish or blackish. The dark markings of the vertex, pronotum, and scutellum give the species a longitudinally striped appearance that is rather distinctive. The aedoeagus is distinctive.

The species has a mainly mountain and Boreal distribution. Alaska, British Columbia, Yukon, Northwest Territories, and northern Ontario.

### Tribe Deltocephalini

Most of the species and many of the genera of this tribe can be named reliably only by examination of the internal male genitalia.

#### Key to genera of Deltocephalini

1. Male genitalia with connective Y-shaped ..... 2
   Male genitalia with connective not Y-shaped, the arms meeting anteriorly ..... 42
2. Male genitalia with a pair of long processes arising at or near base of aedoeagus or apex of connective ..... 3
   Male genitalia without such processes, but sometimes with processes arising from shaft of aedoeagus at or near its apex ..... 13
3. Connection between aedoeagus and processes membranous, so that the aedoeagus appears separate from and dorsal to the processes, which are articulated with the connective ..... 2. *Scaphoideus*
   Processes arising from base of shaft of aedoeagus ..... 4
4. Shaft of aedoeagus double, so that two pairs of processes appear to arise from the bulbous basal portion ..... 17. *Opsius*
   Shaft of aedoeagus not as above ..... 5
5. Shaft and basal processes of aedoeagus curved downward ..... 1. *Prescottia*
   Shaft and basal processes of aedoeagus not curved downward, usually curved upward ... 6
6. Basal processes arising dorsally from basal region of aedoeagus ..... 15. *Paraphlepsius*
   Basal processes arising laterally or ventrally from basal region of aedoeagus ..... 7

7. Terminal portion of male plate produced as a slender, membranous process bearing long, filamentous setae ..... 3. *Osbornellus*
Male plates not as above ..... 8
8. Forewing with reflexed veinlets in costal region in vicinity of outer anteapical cell ..... 11
Forewing without reflexed veinlets in costal region ..... 9
9. Vertex with transverse groove just behind anterior margin; general colour whitish with brown or fuscous markings consisting largely of vermiculate lines or small dots ..... 14. *Norvellina*
Vertex without transverse groove; species not coloured and marked as above ..... 10
10. Aedoeagus greatly reduced; anterior margin of head rounded between vertex and face; forewings short and broad; general colour stramineous ..... 30. *Extrusanus*
Aedoeagus large; anterior margin of head bluntly angled between vertex and face; forewings long; general colour brown or cinereous ..... 7. *Idiodonus*
11. Basal processes of aedoeagus not parallel to shaft, and situated anterior to it ..... 11. *Fitchana*
Basal processes of aedoeagus lying parallel to shaft, and situated largely or entirely posterior to it ..... 12
12. Vertex rounded or obtusely angled in front ..... 9. *Mesamia*
Vertex acutely angled ..... 10. *Twiningia*
13. Connective extended posteriorly below the aedoeagus as a long blade-like process; head distinctly narrower than pronotum ..... 16. *Texanamus*
Connective not as above; head about as wide as or wider than pronotum ..... 14
14. Aedoeagus asymmetrical ..... 15
Aedoeagus symmetrical ..... 22
15. Aedoeagus fused with connective, long and flattened, serrate in lateral view ..... 8. *Ballana*
Aedoeagus and connective articulated, not fused, aedoeagus usually not as above ..... 16
16. Aedoeagus flattened, strap-like, recurved, with apical region expanded as a short, downwardly-directed process at either side ..... 28. *Streptanus*
Aedoeagus not as above ..... 17
17. Gonopore situated at apex of a posteriorly-directed, tube-like process arising from posterior surface of aedoeagus well below its apex; apical region of aedoeagus expanded and with a pair of lateral processes ..... 25. *Thamnotettix*
Aedoeagus not as above; gonopore not on tube-like process ..... 18
18. Aedoeagus very long and slender, recurved ..... 19
Aedoeagus shorter and stouter ..... 21
19. Aedoeagus forked at apex ..... 20
Aedoeagus not forked at apex ..... 24. *Macustus*
20. Smaller species, length about 3.0 mm. ..... 37. *Stenometopiellus*
Larger species, length 5.0 mm. or more ..... 23. *Euscelis*
21. Anterior margin of head rounded between vertex and face; vertex convex; aedoeagus short, stout, strongly recurved, and without processes ..... 4. *Allygus*
Anterior margin of head distinctly angled between vertex and face; vertex flat or slightly concave; aedoeagus simple and recurved, or with apical processes, or curved downward ..... 15. *Paraphlepsius*
22. Anterior margin of head transversely carinate between ocelli; vertex broad and flat; entire body and forewings fairly evenly covered with small, brown dots ..... 18. *Fieberiella*
Not as above ..... 23
23. Forewing with rounded, hyaline areas, especially in the apical and subapical regions; aedoeagus forked at apex and with gonopore at apex of a dorsal, tube-like projection ..... 12. *Bandara*
Forewing without such hyaline areas; aedoeagus not as above ..... 24
24. Male plate bilobed, lying in a nearly vertical plane, the plates not meeting at mid line ..... 36. *Hardya*
Male plates not as above ..... 25
24. Anterior margin of head distinctly angled between vertex and face ..... 26
Anterior margin of head rounded between vertex and face ..... 27
26. Smaller species, length 4.0 mm. or less; usually brachypterous; vertex largely pale with three large, black spots at anterior margin ..... 38. *Doratura*
Larger species, length 5.0 mm. or more; macropterous; vertex not marked as above ..... 15. *Paraphlepsius*
27. Vertex with a distinct transverse groove ..... 13. *Aligia*
Vertex without transverse groove, usually convex or flat ..... 28

28. Clypellus constricted at base or at middle and always wider at apex than at constriction; macropterous ..... 29
Clypellus not distinctly wider at or near apex than at middle or near base; macropterous, subbrachypterous, or brachypterous ..... 34
29. Texture of vertex dull, granulose; species without definite dark markings; aedoeagus with one or two pairs of apical processes ..... 5. *Chlorotettix*
Vertex either smooth and shining or finely longitudinally striate, at least in the median and posterior regions; species often with definite dark markings, if without such markings then aedoeagus without apical processes ..... 30
30. Aedoeagus with a pair of reflexed processes at apex; forewings usually strongly marked ..... 6. *Colladonus*
Aedoeagus without such processes; forewings without well-defined dark markings ..... 31
31. Aedoeagus long and slender with a pair of lateral processes beyond middle, beyond which it is narrowed in lateral view ..... 20. *Calanana*
Aedoeagus not as above, usually simple ..... 32
32. Male pygofer with a long, blade-like process from posterior margin; species without definite dark markings ..... 21. *Paluda*
Male pygofer without a long, blade-like process, sometimes with one or more short, spine-like processes; species sometimes with definite dark markings on vertex ..... 33
33. Vertex with a row of black spots or a black band across anterior margin ..... 19. *Cicadula*
Vertex without such black markings ..... 22. *Elymana*
34. Brachypterous with the apex of the forewing truncate, or macropterous with the venation irregular ..... 38. *Doratura*
Macropterous or subbrachypterous with the apex of the forewing never truncate and the venation not irregular ..... 35
35. Appendix extending around entire apex of forewing ..... 35. *Exitianus*
Appendix not extending beyond second apical cell of forewing ..... 36
36. Posterior margin of male pygofer produced as a stout, spine-like process ..... 33. *Limotettix*
Posterior margin of male pygofer without such process ..... 37
37. Aedoeagus flattened, with a pair of large processes arising at or near middle of shaft ..... 29. *Coulinus*
Aedoeagus either not flattened, or without processes, or with processes at apex only ..... 38
38. Aedoeagus not forked and not with processes at apex ..... 26. *Doliotettix*
Aedoeagus either forked or with a pair of apical processes ..... 39
39. Vertex with a transverse row of four large black spots near anterior margin 31. *Frigartus*
Vertex not marked as above ..... 40
40. Vertex with a well-defined black transverse band; large species, length 7.0 mm. or more ..... 32. *Athysanus*
Vertex not marked as above, smaller species, length 6.0 mm. or less ..... 41
41. Aedoeagus long and slender, with the extreme apex expanded to form a short, downwardly-directed process at each side; larger species, length 5.0-6.0 mm. 27. *Euscelidius*
Aedoeagus short and stout, with apex forked; smaller species, length not over 5.0 mm. ..... 34. *Scleroracus*
42. Aedoeagus and connective fused ..... 43
Aedoeagus and connective articulated ..... 53
43. Aedoeagus strongly curved downward ..... 62. *Cabrulus*
Aedoeagus not curved downward, usually curved upward ..... 44
44. Brachypterous with apex of forewing obliquely truncate, or macropterous with venation irregular ..... 67. *Lonatura*
Macropterous or subbrachypterous with apex of the forewing rounded and venation not irregular ..... 45
45. Forewing with one or more nearly straight veins that extend obliquely forward from the outer anteapical cell to meet the costa at an angle (Fig. 1272); vertex long, flat, pointed ..... 55. *Flexamia*
Forewing with vein from outer anteapical cell meeting costa at or almost at a right angle ..... 46
46. Central anteapical cell of forewing divided ..... 47
Central anteapical cell of forewing not divided ..... 51
47. Vertex flat or nearly so, the anterior margin clearly defined; forewing without definite dark markings ..... 70. *Amplicephalus*
Vertex convex, and rounded to the face so that the anterior margin is not clearly defined; forewing with definite dark markings ..... 48

48. Inner anteapical cell of forewing open basally (Fig. 1277) ..... 69. *Graminella*
Inner anteapical cell of forewing closed basally ..... 49
49. Forewing without extra crossveins ..... 63. *Deltocephalus*
Forewing with extra crossveins ..... 50
50. Extra crossveins limited to clavus (Fig. 1274) ..... 66. *Endria*
Extra crossveins not limited to clavus (Fig. 1275) ..... 65. *Polyamia*
51. Inner anteapical cell of forewing closed basally ..... 64. *Unoka*
Inner anteapical cell of forewing open basally ..... 52
52. Outer anteapical cell of forewing centered directly below middle of central anteapical cell (Fig. 1277); rather slender species with forewing extending well beyond tip of abdomen ..... 69. *Graminella*
Outer anteapical cell of forewing either small and centered directly below apical half of central anteapical cell (Fig. 1276), or absent; robust species with the forewing barely exceeding tip of abdomen in length ..... 68. *Amblysellus*
53. Aedoeagus asymmetrical and strongly curved downward ..... 52. *Lemellus*
Aedoeagus symmetrical and usually not curved downward ..... 54
54. Aedoeagus with only a membranous connection with a pair of long processes that are articulated with the connective ..... 45. *Auridius*
Male genitalia without such processes ..... 55
55. Aedoeagus largely enclosed in a sclerotized, dorsal, hood-like development of the tenth segment ..... 61. *Commellus*
Aedoeagus not enclosed in a dorsal, hood-like structure ..... 56
56. Vertex with a well-defined, black, transverse band ..... 57
Vertex not marked as above, or without dark markings ..... 58
57. Aedoeagus very broad in lateral view, slender in ventral view, with the gonopore at apex of shaft ..... 41. *Paramesus*
Aedoeagus slender in lateral view, with the gonopore at about middle of posterior surface of shaft ..... 42. *Pasaremus*
58. Colour strongly green or bright yellowish-green ..... 59
Colour usually stramineous or yellowish, sometimes dull yellowish-green or stramineous with a greenish tinge ..... 60
59. Male plate with a lateral lobe; aedoeagus curved posteriorly on apical third 53. *Verdanus*
Male plate without a lateral lobe; aedoeagus not curved posteriorly on apical third ..... 49. *Sorhoanus*
60. Brachypterous with the forewing ending at apex of clavus, or, rarely, macropterous with venation irregular ..... 61
Macropterous or subbrachypterous with venation not irregular ..... 62
61. Vertex short and broad, barely longer at middle than next the eye; clypellus almost parallel-sided ..... 39. *Driotura*
Vertex much longer at middle than next the eye, usually bluntly angled; clypellus much broader at base than at apex ..... 40. *Athysanella*
62. Posterior margin of male pygofer produced as a long, spine-like process that ends in an expanded hook-like portion, the process directed internally to cross the mid line and overlap with the process of the opposite pygofer ..... 48. *Arthaldeus*
Pygofer without such process, sometimes with a spine-like process that is not directed internally ..... 63
63. Forewing with one or more nearly straight veins that extend obliquely forward from outer anteapical cell to meet costa at an angle (Fig. 1272); vertex long, flat, pointed ..... 55. *Flexamia*
Forewing with veins from outer anteapical cell meeting costa at or almost at right angles 64
64. Clypellus relatively long, almost parallel-sided; clypeal suture obscure ..... 43. *Palus*
Clypellus relatively short, much broader at base than at apex; clypeal suture distinct ... 65
65. Colour golden or orange-yellow, without dark markings ..... 44. *Orocastus*
Colour not golden or orange-yellow, usually with some dark markings ..... 66
66. Shaft of aedoeagus split for two-thirds of its length ..... 58. *Pinumius*
Shaft of aedoeagus not split for two-thirds of its length, sometimes forked at apex ..... 67
67. Connective about twice as long as aedoeagus; aedoeagus without apical processes or projections ..... 47. *Psamotettix*
Connective short, usually shorter than aedoeagus; aedoeagus usually with a pair of lateral processes at apex or with apical region extended laterally as pointed projections ..... 68

68. Usually subbrachypterous, rarely macropterous in which event forewings barely reaching tip of abdomen and appendix absent; dark markings of body and forewings indistinct or absent ..... 46. *Mocuellus*
Macropterous with forewings reaching or exceeding tip of abdomen and appendix present; body and forewings usually with distinct dark markings ..... 69
69. Apical region of aedoeagus forked and without processes; apical region of style very long and stout, its upper, inner margin with a row of rounded projections ..... 54. *Diplocolenus*
Apical region of aedoeagus not forked, usually with processes or lateral projections; style not as above ..... 70
70. Aedoeagus with a pair of downwardly-directed, spine-like processes on ventral surface just below apex ..... 50. *Cazenus*
Processes of apical region of aedoeagus, when present, not arising from ventral or posterior surface ..... 71
71. Aedoeagus strongly curved downward at middle in lateral view, with apical processes about half as long as shaft ..... 57. *Errastunus*
Aedoeagus not curved downward at middle, with apical processes, when present, much less than half length of shaft ..... 72
72. Apex of style produced beyond base of lateral arm as a stout, tapering projection; aedoeagus relatively long; male pygofer relatively long, its margin without a hook-like or dentate process ..... 51. *Laevicephalus*
Apex of style either not produced beyond base of lateral arm or produced only as several small rounded projections; aedoeagus relatively short; male pygofer shorter, usually with one or more hook-like or dentate projections on margin ..... 73
73. Lateral arm of style at right angles to main axis and often curved downward; style with several rounded projections on apical margin; apical region of aedoeagus produced as a digitate or spine-like projection at either side ..... 60. *Hebecephalus*
Lateral arm of style not at right angles to main axis; apical margin of style usually not produced, not as above; apical region of aedoeagus usually not as above ..... 74
74. Apical region of aedoeagus expanded and with serrated lateral margins ..... 59. *Rosenus*
Apical region of aedoeagus not as above, usually with one or more pairs of processes ..... 56. *Latalus*

### Genus 1. *Prescottia* Ball

*Prescottia lobata* (Van D.) (Figs, 298, 629, 1063).—Length: 5.0-6.0 mm. Vertex and thorax light ochreous-yellow with the markings brown; forewing whitish or greyish-white, tinged with yellowish-brown in the anteapical cells, with the markings dark brown. The markings and the aedoeagus are distinctive.

Widely distributed in southern Ontario, southern Quebec, and New Brunswick. Host plants: probably some herbaceous plants.

### Genus 2. *Scaphoideus* Uhl.

Rather large insects that are not normally collected in numbers. They are usually found on low vegetation in open woods, and it is probable that the nymphs feed on trees. It is likely that species additional to those listed below will be found in Canada. Identification of the species is primarily on characters of the internal male genitalia. The aedoeagus is small and there is only a membranous connection between it and a pair of large processes, or paraphyses, that are fused with the connective. The genus was revised by DeLong (1939).

#### Key to species of *Scaphoideus*

1. Male genitalia with paraphyses parallel in ventral view ..... 2
Paraphyses curved inward in ventral view and usually crossing each other ..... 8
2. Paraphyses more than twice as long as aedoeagus ..... 3
Paraphyses not more than one and one-half times as long as aedoeagus, often equal to or shorter than aedoeagus ..... 6
3. Aedoeagus with a large, hook-like process at either side; apical third of each paraphysis slender in lateral view ..... 13. *intricatus*
Aedoeagus without such processes; paraphyses not distinctly narrowed on apical third ... 4
4. Aedoeagus stout, U-shaped in lateral view; paraphyses each triangularly expanded before apex in ventral view, with apical region tapered and strongly pointed 7. *major*

Aedoeagus more slender, not distinctly U-shaped in lateral view; paraphyses each not triangularly expanded, distinctly curved downward at apical region in lateral view, with apex not tapered ..... 5

5. Paraphyses slender, each angled downward at apical fourth in lateral view ..... 9. *immistus*
Paraphyses more stout, apical fourth slightly but distinctly curved downward, not angled ..... 6. *melanotus*

6. Paraphyses about one and one half times as long as aedoeagus ..... 12. *diutius*
Paraphyses equal to or shorter than aedoeagus in length ..... 7

7. Paraphyses as long as aedoeagus ..... 10. *littoralis*
Paraphyses shorter than aedoeagus ..... 11. *amplus*

8. Paraphyses not or only slightly curved upward in lateral view ..... 5. *merus*
Paraphyses in lateral view either strongly curved upward or with apical region curved downward ..... 9

9. Paraphyses curved upward in lateral view ..... 10
Paraphyses each with apical region sharply angled downward in lateral view 4. *transeus*

10. Paraphyses recurved in ventral and lateral views ..... 2. *carinatus*
Paraphyses not recurved ..... 11

11. Each paraphysis constricted on upper margin near apex ..... 8. *elongatus*
Paraphyses not as above ..... 12

12. Paraphyses each almost right angled at middle in lateral view ..... 3. *cylindratus*
Paraphyses each with apical half strongly curved, not angled ..... 1. *frisoni*

1. *Scaphoideus frisoni* DeL. & Mohr (Figs. 303, 633, 1064).—Length: 5.5-6.0 mm. Ochreous with the transverse band of the vertex orange or brown and the other dark markings of the body brown; forewing tinged with yellowish-brown and with the veins and markings brown. The male genitalia are distinctive.

Southern Quebec.

2. *Scaphoideus carinatus* Osb. (Figs. 301, 632, 1065).—Length: 6.0-7.0 mm. Ochreous with the markings brown; forewing greyish-brown with the veins and markings dark brown. A rather strongly-marked species, often distinctly greyish in general appearance. The male genitalia are distinctive.

Southern Ontario and southern Quebec.

3. *Scaphoideus cylindratus* DeL. & Beery (Figs. 300, 631, 1066).—Length: 5.0-6.0 mm. Ochreous with the markings brown; forewing tinged with brownish and with the veins and markings dark brown. The male genitalia are distinctive.

Southern Ontario and southern Quebec.

4. *Scaphoideus transeus* DeL. & Beery (Figs. 302, 630, 1067).—Length: 5.0-6.0 mm. Ochreus with the mrakings brown; forewing tinged with brownish and with the veins and markings dark brown. The male genitalia are distinctive.

Southern Ontario.

5. *Scaphoideus merus* DeL. & Beery (Figs. 304, 1068).—Length: 5.5 mm. Ochreous with the transverse band of the vertex reddish-brown, darker anteriorly, the line at the margin of the vertex dark brown, and the pronotum and scutellum marked with reddish-brown and brown; forewing whitish, largely tinged with light brownish and with the veins and markings dark brown. The male genitalia are distinctive.

Southern Quebec.

6. *Scaphoideus melanotus* Osb. (?*obtusus* Osb., ?*crassus* DeL. & Mohr, ?*curvatus* DeL. & Mohr) (Figs. 307, 635, 1069).—Length: 4.0-5.0 mm. Ochreous with the markings brown; forewing greyish-white with the veins and markings dark brown. A rather small, distinctly greyish-tinged insect. The male genitalia are distinctive.

Widely distributed in southern Ontario and southern Quebec.

7. *Scaphoideus major* Osb. (Figs. 308, 1070).—Length: 5.5-6.5 mm.

Ochreous with the markings brown; forewing tinged with brownish and with the veins and markings dark brown. The male genitalia are distinctive.

Southern Manitoba and southern Ontario. Host plant: possibly willow.

8. *Scaphoideus elongatus* DeL. & Beery (Figs. 299, 1071).—Length: 5.0 mm. Ochreous with the transverse band of the vertex reddish-brown and the other dark markings brown; forewing tinged with brownish and with the veins and markings dark brown. The male genitalia are distinctive.

Southern Ontario and southern Quebec.

9. *Scaphoideus immistus* (Say) (Figs. 305, 1072).—Length: 4.5-5.5 mm. Ochreous with the markings brown and reddish-brown; forewing tinged with brownish and with the veins and markings dark brown. The male genitalia are distinctive.

Southern Ontario and southern Quebec. Host plants: possibly *Salix* spp.

10. *Scaphoideus littoralis* Ball.—Length: 4.5-5.5 mm. Ochreous with the markings brown; forewings tinged with brownish and with the veins and markings dark brown. The male genitalia are distinctive.

Southern Ontario and southern Quebec.

11. *Scaphoideus amplus* DeL. & Mohr (Figs. 306, 636, 1073).—Differing from *littoralis* only in the relative length of the paraphyses, and perhaps conspecific with that species and *diutius*.

Southern Ontario and southern Quebec.

12. *Scaphoideus diutius* DeL. & Mohr.—Differing from *littoralis* only in the relative length of the paraphyses, and perhaps conspecific with that species and *amplus*.

Southern Ontario and southern Quebec.

13. *Scaphoideus intricatus* Uhl. (Figs. 309, 634, 1075).—Length: 5.0-6.0 mm. White with the markings dark brown and the cells of the forewing partly tinged with brownish. The white head and thorax and the white areas of the forewing are distinctive; other Canadian species of the genus have the ground colour ochreous. The male genitalia are distinctive.

Southern Ontario. Host plant: Possibly dogwood.

### Genus 3. *Osbornellus* Ball

Species of this genus fall readily into two groups on a basis of external characters, but for reliable specific identifications the genitalic characters must be examined. The North American species were revised by Beamer (1937).

#### Key to species of *Osbornellus*

1. Dark markings of vertex as two transverse bands ..... 2
   Dark markings of vertex not as two transverse bands ..... 3
2. Processes of aedoeagus tapered in ventral view; apex of style not distinctly expanded; female seventh sternum not deeply emarginate ..... 2. *limosus*
   Processes of aedoeagus in ventral view each parallel-sided to near apex, then curved outward; style distinctly expanded at apex; female seventh sternum deeply emarginate ..... 1. *auronitens*
3. Processes of aedoeagus branching; female seventh sternum long, its posterior margin bilobed ..... 3. *consors*
   Processes of aedoeagus not branching; female seventh sternum short, its posterior margin trilobed ..... 4. *borealis*

1. *Osbornellus auronitens* (Prov.) (*areatus* Van D.) (Figs. 310, 637, 1076). Length: 5.0-5.5 mm. Vertex yellow with the anterior transverse band black and the posterior orange-red, black-margined in middle anteriorly; pronotum yellowish, suffused with light brown posteriorly and with orange-red areas near the anterior margin and in the middle; scutellum yellow with the markings

light reddish-brown. This species resembles the following on a basis of external characters but the genitalic characters are distinctive.

Widely distributed in southern Ontario and southern Quebec. Host plants: probably ferns.

2. *Osbornellus limosus* DeL. (Figs. 311, 638, 1077).—Length: 5.5-6.0 mm. Colour and markings as in *auronitens*, from which the species can be distinguished by the genitalic characters.

Southern Ontario. Host plants: probably ferns.

3. *Osbornellus consors* (Uhl.) (Figs. 312, 639, 1078).—Length: 4.5-5.5 mm. Vertex yellowish with the markings brown and dark brown; pronotum yellowish, heavily suffused with brown and marked with dark brown; scutellum yellow with the markings dark brown; forewings tinged with brown and with the veins and markings dark brown. This species resembles *borealis* on a basis of external characters but can be distinguished by the genitalic characters.

Apparently widely distributed in the southern parts of Saskatchewan, Manitoba, Ontario, and Quebec, and in New Brunswick.

4. *Osbornellus borealis* DeL. & Mohr (Figs. 313, 640, 1079).—Length: 4.5-5.6 mm. Colour and markings as in *consors* but with the forewings usually more strongly tinged with brownish and the veins and markings relatively darker, so that in general appearance this is usually a rather darker insect. The genitalic characters are distinctive.

Widely distributed and locally common in southern British Columbia and also found in southern Alberta and southern Saskatchewan.

### Genus 4. *Allygus* Fieb.

*Allygus mixtus* (Fab.) (Figs. 314, 641, 1080).—Length: 6.0-7.0 mm. Vertex and thorax ochreous-yellow with the markings black and brown; forewings tinged with brownish, with the veins, particularly the crossveins, variably marked with white and with the irrorations dark brown or blackish. There is variation in the extent of the dark markings. The markings and the genitalic characters are distinctive.

Widely distributed in southern British Columbia. It has been found also in northeastern United States and consequently may occur in southern Ontario. The species probably is an introduction from Europe. Host plants: woody plants.

### Genus 5. *Chlorotettix*, Van D.

Green or brownish insects without definite dark markings. The aedoeagus or the female seventh sternum must be examined for reliable specific identifications. The nymphs feed on grasses. The North American species were discussed by Brown (1933), but a number of additional species were subsequently described.

#### Key to species of *Chlorotettix*

| | | |
|---|---|---|
| 1. | Males | 2 |
| | Females | 10 |
| 2. | Aedoeagus long and slender | 4 |
| | Aedoeagus short and stout | 3 |
| 3. | Aedoeagus with a single pair of processes at apex | 1. *tergatus* |
| | Aedoeagus with two pairs of processes at apex | 4. *lusorius* |
| 4. | Aedoeagus with a single pair of processes, sometimes branched, at apex | 5 |
| | Aedoeagus with two pairs of processes at apex | 7 |
| 5. | Processes of aedoeagus branched | 6 |
| | Processes of aedoeagus not branched | 2. *galbanatus* |
| 6. | Processes branched near base, not curved anteriorly | 5. *dentatus* |
| | Processes branched beyond middle, curved anteriorly | 3. *balli* |

7. Inner pair of processes very short ..... *6. unicolor*
Inner pair of processes half as long as the outer, or longer ..... 8
8. Inner pair of processes about half as long as the outer ..... 9
Inner pair of processes about as long as the outer ..... *8. limosus*
9. Outer pair of processes almost straight ..... *7. similis*
Outer pair of processes strongly curved ..... *9. attenuatus*
10. Seventh sternum with a median projection on posterior margin ..... 11
Seventh sternum without such projection ..... 15
11. Median projection spatulate, wider near apex than at base ..... 12
Median projection wider near base than at apex ..... 13
12. Median projection rounded at apex ..... *3. balli*
Median projection bilobed at apex ..... *8. limosus*
13. Median projection rounded at apex ..... *4. lusorius*
Median projection bilobed at apex ..... 14
14. Postero-lateral corners of seventh sternum rounded ..... *5. dentatus*
Postero-lateral corners of seventh sternum pointed ..... *9. attenuatus*
15. Seventh sternum much longer than wide, its posterior margin as two rounded lobes that often overlap at the mid line ..... *7. similis*
Seventh sternum as wide as or wider than long, its posterior margin emarginate at middle ..... 16
16. Median emargination of seventh sternum U-shaped, postero-lateral corners of sternum rounded ..... 17
Median emargination V-shaped, postero-lateral corners of sternum sharply pointed ..... *6. unicolor*
17. Sides of emargination parallel ..... *2. galbanatus*
Sides of emargination diverging ..... *1. tergatus*

1. *Chlorotettix tergatus* (Fitch) (Figs. 320, 649, 1085).—Length: 7.5 mm. Green or brownish-green without definite dark markings. The genitalic characters are distinctive.

Southern Ontario and southern Quebec.

2. *Chlorotettix galbanatus* Van D. (Figs. 321, 645).—Length: 7.0-8.0 mm. Brownish-green without definite dark markings. The genitalic characters are distinctive (male not figured).

Southern Ontario.

3. *Chlorotettix balli* Osb. (Figs. 322, 644, 1083).—Length: 6.5-7.0 mm. Light green or light ochreous-green without definite dark markings. The genitalic characters are distinctive.

Widely distributed in the southern parts of Manitoba, Ontario, and Quebec.

4. *Chlorotettix lusorius* (Osb. & Ball) (Figs. 316, 643, 1082).—Length: 7.0-8.0 mm. Brownish, sometimes with indications of a darker transverse band on the vertex and often with the veins of the forewing paler brown. The genitalic characters are distinctive.

Local, with a mainly Boreal distribution. British Columbia, Alberta, Saskatchewan, Ontario, Quebec, and Nova Scotia.

5. *Chlorotettix dentatus* Sand. & DeL. (Figs. 318, 646).—Length: 8.0 mm. Light green, yellowish-green, or light brownish-yellow, without definite dark markings. The genitalic characters are distinctive (male not figured).

Southern Ontario.

6. *Chlorotettix unicolor* (Fitch) (*vanduzeei* Bak.) (Figs. 315, 642, 1081).—Length: 6.0-7.0 mm. Light green, ochreous-green, or ochreous, without dark markings. The genitalic characters are distinctive.

Widely distributed and locally common in the southern and Boreal regions of British Columbia, Northwest Territories, Alberta, Saskatchewan, Manitoba, Ontario, and Quebec. It occurs in grasslands.

7. *Chlorotettix similis* DeL. (Figs. 319, 647, 1084).—Length: 7.0 mm. Pale green without dark markings. The genitalic characters are distinctive.

Southern British Columbia. It is a vector of California aster yellows.

8. *Chlorotettix limosus* DeL. & Crt. (Figs. 317, 648).—Length: 8.0 mm. Yellowish-green, slightly darkened along the commissure but without definite dark markings. The genitalic characters are distinctive (male not figured).

Southern Quebec.

9. *Chlorotettix attenuatus* Brown (Figs. 323, 1086).—Length: 7.0-8.0 mm. Pale yellowish-green without dark markings. The genitalic characters are distinctive.

Southern Ontario.

### Genus 6. *Colladonus* Ball (*Friscananus* Ball, *Friscanus* DeL. & Crt., *Hypospadianus* Rib.)

Some species of this genus are difficult to name reliably at present, as specific characters sometimes are slight and there is much individual and local variation. At time of writing the genus is being revised by M. W. Nielson. Publication of this revision may necessitate changes in the species concepts as described here. Forms other than those listed below that are at present regarded as valid species and that have been found in Canada include *arctostaphylus* Downes, *atriflavus* Downes, *nigrax* (Van D.), *tahotus* Ball, *egenus* Ball, and *mendicus* (Ball). These, together with some species previously undescribed, will be discussed by Nielson.

#### Key to species of *Colladonus*

1. Vertex with a pair of black spots at anterior margin ..... 2
   Vertex without such spots ..... 6
2. Forewing dark brown or blackish, with a large, yellow area on commissure occupying much or most of clavus and with costal region broadly yellow ..... 3
   Forewing not as above, brownish with the veins largely paler ..... 5
3. Vertex with a broad, dark brown or blackish band across posterior margin ..... 4
   Vertex without such band ..... 5. *clitellarius*
4. Yellow area of clavus extending from scutellum to apex; head bluntly pointed ..... 3. *collaris*
   Yellow area of clavus not reaching scutellum or apex; head rounded ..... 4. *furculatus*
5. Veins of corium largely pale; pronotum with a broad, brownish band across anterior margin; posterior margin of female seventh sternum with a median notch or emargination ..... 2. *torneellus*
   Veins of corium largely dark; anterior region of pronotum not darker than the remainder; posterior margin of female seventh sternum with a median projection ..... 1. *geminatus*
6. Forewing brown, dark brown, or blackish, with a well-defined, large, yellowish area on clavus at middle of commissure and with costal region pale ..... 7
   Forewing without a well-defined, large, yellowish area on clavus at middle of commissure, but sometimes with that region paler than remainder of clavus, or with claval veins pale near commissure ..... 8
7. Vertex with a dark brown or blackish band across posterior margin; posterior margin of female seventh sternum with a median projection that is relatively short and not spatulate ..... 6. *montanus*
   Vertex wholly pale, posterior margin of female seventh sternum with a long, spatulate, median projection ..... 7. *eburatus*
8. Head and thorax golden brown; forewing uniformly hyaline-ochreous or pale reddish-ochreous; posterior margin of male pygofer with a long, curved, flattened process ..... 9. *aureolus*
   Not coloured as above, but forewing with distinct dark and pale areas or markings; male pygofer with a straight, spine-like process ..... 9

9. Pronotum with a broad, brownish or blackish band across anterior margin and vertex with a similarly-coloured band scross posterior margin ..... 6. *montanus*
Pronotum either of uniform colour throughout or paler toward anterior margin; vertex with the posterior region sometimes darker than the anterior but the darkening not as a definite band ..... 8. *flavocapitatus*

1. *Colladonus geminatus* (Van D.) (Figs. 324, 650, 1087).—Length: 4.5-5.0 mm. Pale yellowish or greenish-yellow with the spots of the vertex black, the pronotum with black markings near the anterior margin and sometimes partly suffused with brownish or fuscous, the markings of the scutellum blackish, and the forewings whitish or ochreous-hyaline, sometimes smoky, with the veins of the clavus whitish and those of the corium dark brown. There is variation in the extent and intensity of the dark markings. The species resembles superficially some species of *Macrosteles* (*Sonronius*), *Cicadula*, or *Exitianus* but can be recognized as a species of *Colladonus* by the genitalic characters. It can be distinguished from *torneelus* by the characters given in the key.

Widely distributed and locally abundant in southern British Columbia. It is known to be a vector of California aster yellows, western X-disease of cherry and peach, and yellow leaf-roll of peach.

2. *Colladonus torneellus* (Zett.) (*oxalidis* Fieb., *belli* Uhl., *gillettei* Van D., *sonorae* Gill. & Bak., *brunneus* Osb., *semipullatus* Osb.) (Figs. 325, 326, 651, 1088).—Length: 3.5-5.0 mm. Vertex pale yellow with the spots at the anterior margin black and with a broad, indefinite, light brown, dark brown or, occasionally, blackish transverse band that usually terminates at either end in a black spot; pronotum ochreous, usually more or less suffused with light brown, with brownish or blackish markings or a transverse band at anterior margin and with posterior margin usually narrowly darkened; scutellum yellow with the markings blackish; forewing hyaline ochreous, brownish, or fuscous, with the veins ochreous. As indicated here, variation in colour and markings is extensive. There is also some variation in the shape of the female seventh sternum and of the apical region of the male style and pygofer. The colour and markings and the genitalic characters are distinctive. There is a possibility that this may be a complex of several closely-related species.

Widely distributed and locally common, mainly in the North. Alaska (including a locality on the tundra), northern British Columbia, southern British Columbia (up to 5,000 feet), Yukon, Northwest Territories, Alberta, Saskatchewan, southern and northern Manitoba, Boreal regions of Ontario and Quebec, and Labrador.

3. *Colladonus collaris* (Ball) (*exquisitos* Osb.) (Figs. 327, 652).—Length: 5.5-6.0 mm. Black and yellow, the forewing with the costal region whitish-yellow and the apical region semihyaline blackish-brown. A relatively large species with distinctive markings.

Southern Ontario.

4. *Colladonus furculatus* (Osb.) (Figs. 328, 1089).—Length: 4.5-5.0 mm. Head and thorax yellow and black; forewing blackish-brown and yellow. The black band at the posterior margin of the vertex distinguishes the species from *clitellarius* and the smaller size and the shape of the yellow areas of the forewing distinguish it from *collaris*. The relatively long apical processes of the aedoeagus and the shape of the apical region of the style are distinctive.

Southern Ontario.

5. *Colladonus clitellarius* (Say) (Figs. 329, 653, 1090).—Length: 4.5-5.0 mm. Yellow and black, the forewing semihyaline blackish in the apical region and

with the costal region yellowish-white. The var. *marcidus* Ball has the dark areas of the body and forewings, other than the apical spots of the vertex, brown or blackish-brown rather than black. The markings, the female seventh sternum, and the apical region of the style are distinctive.

Widely distributed and locally common in southern Ontario and southern Quebec. It is a vector of X-disease of peach and cherry.

6. *Colladonus montanus* (Van D.) (Figs. 330, 331, 654, 1091).—Length: 4.5-5.0 mm. The male of the typical form (Fig. 330) is yellow and blackish, with the vertex brown or blackish posteriorly, and the costal region of the forewing whitish-yellow, and often with a pair of black spots at the anterior margin of the vertex. The female has the dark areas of the body and forewings brown or golden brown. The golden brown form is var. *mulsus* Ball. Var. *reductus* Van D. (Fig. 331) has the pale area of the clavus represented only by the claval veins being pale near the commissure and lacks dark spots at the anterior margin of the vertex. The dark posterior band of the vertex and anterior band of the pronotum distinguishes the species from others that occur in the same region.

Widely distributed and locally abundant in southern British Columbia, especially in dry regions. It is a vector of California aster yellows and western X-disease of peach and cherry.

7. *Colladonus eburatus* (Van D.) (Figs. 332, 655, 1092).—Length: 5.0-5.5 mm. Pale yellow with the markings brown or golden and the forewing with the costal region usually whitish and the apical region partly fuscous, and the pronotum often brown or dark brown along the anterior margin. There is variation in the extent and intensity of the dark markings. The markings and the female seventh sternum are distinctive.

Mountain districts of southern British Columbia and southern Alberta and the Boreal regions of Manitoba and Quebec.

8. *Colladonus flavocapitatus* (Van D.) (? *waldanus* Ball) (Figs.333-335, 656, 1093-1095).—Length: 4.5-5.5 mm. In general, the forewing is golden brown becoming more hyaline in the costal region, with the apices of the claval veins pale and the apical cells usually tinged with fuscous. Typical *flavocapitatus* (Fig. 333) has the vertex yellow and the male pygofer with a relatively long spine (Fig. 1093); *waldanus* (Fig. 334) has the vertex golden brown posteriorly, the forewing with the veins of the corium largely fuscous and with a fuscous suffusion in the apical cells, and the posterior margin of the male pygofer with a shorter, more upwardly-directed spine (Fig. 1094); a third, unnamed, form (Fig. 335) has the vertex usually tinged with brownish posteriorly, and the posterior margin of the male pygofer with a short spine that is situated largely inside the pygofer (Fig. 1095), and is more uniformly pale golden brown in colour. There is some intergrading between these three forms and it is possible that they are valid species.

Specimens that agree with the description of *flavocapitatus* are from Alaska, British Columbia, Yukon, and Northwest Territories. This species, or variety, is a vector of California aster yellows. Specimens that agree with the description of *waldanus* are from Alaska, Yukon, Northwest Territories, southern Manitoba, and southern Ontario. Specimens of the third form described above are from southern Quebec.

9. *Colladonus aureolus* (Van D.) (Figs. 336, 657, 1096).—Length: 5.0 mm. Head and thorax golden brown, usually with a reddish tinge; forewing hyaline

ochreous or pale reddish-ochreous. The colour and the large, flat, curved process of the male pygofer are distinctive.

Southern British Columbia.

### Genus 7. *Idiodonus* Ball (*Josanus* DeL., *Orolix* Rib.)

#### Key to species of *Idiodonus*

1. Vertex with distinct black or dark brown markings near anterior margin ..... 2
   Vertex without black spots ..... 1. *aurantiacus*
2. Claval suture whitish, contrasting with remainder of wing ..... 3. *kennecotti*
   Claval suture not paler than remainder of wing ..... 2. *morsei*
1. Vertex with distinct black or dark brown markings near anterior margin ..... 2
   Vertex without dark markings ..... 1. *coloradensis*
2. Forewing with apical half of clavus and adjoining part of corium largely blackish ..... 2. *nigridorsum*
   Forewing with these areas largely pale ..... 3. *straminea*

1. *Idiodonus aurantiacus* (*Prov.*) (*?cockerelli* Ball) (Figs. 337, 1097).—Length: 4.5-5.5 mm. Brownish or ochreous-brown, closely speckled with red throughout. There is variation in the intensity of the red speckling, so that the general hue of the insect varies from ochreous-brown to dark reddish-brown. The markings are distinctive.

Local but widely distributed in the West. Alaska, British Columbia (up to 4,500 feet), Yukon, Alberta, and Saskatchewan.

2. *Idiodonus morsei* (Osb.) (Figs. 338, 1098).—Length: 5.0-6.5 mm. Cinereous, usually speckled with red on the vertex, pronotum, and scutellum and along the veins of the forewing. The two black spots on the vertex margin readily distinguish it from *aurantiacus*.

Widely distributed but local, in the southern parts of British Columbia, Alberta, Saskatchewan, Manitoba, and Ontario, and in New Brunswick.

3. *Idiodonus kennecotti* (Uhl.) (*brittoni* Osb.) (Figs. 339, 658, 1099).—Length: 6.0-7.0 mm. Cinereous with the vertex yellow anteriorly and posteriorly, the pronotum usually with a yellow transverse band, and the scutellum usually yellow at the sides; forewing usually becoming paler toward the costa, with the claval suture broadly yellow, and often with the claval veins yellow. The markings are distinctive.

This species has a mainly Boreal distribution and has been found in British Columbia, Alberta, Saskatchewan, Manitoba, Ontario, Quebec, and New Brunswick.

### Genus 8. *Ballana* DeL.

Members of this genus are difficult to name reliably on a basis of existing literature. Specific characters are largely in the internal male genitalia. There is reason to believe that species additional to that described below occur in British Columbia.

*Ballana titusi* (Ball) (Figs. 340, 659, 1100).—Length: 5.0-5.5 mm. Yellowish-green without dark markings; forewing tinged with smoky toward apex. The genitalic characters are distinctive.

Widely distributed in southern British Columbia.

### Genus 9. *Mesamia* Ball

Species of this genus are rather local in their distributions in Canada. It is likely that one or more additional species will be found in the West.

#### Key to species of *Mesamia*

1. Vertex with distinct black or dark brown markings near anterior margin ..... 2
   Vertex without dark markings ..... 1. *coloradensis*

2. Forewing with apical half of clavus and adjoining part of corium largely blackish ..... 2. *nigridorsum*

Forewing with these areas largely pale ..... 3. *straminea*

1. *Mesamia coloradensis* (Gill. & Bak.) (*?ludovicia* Ball) (Figs. 343, 660, 1101).—Length: 4.5 mm. Pale green or pale ochreous; vertex usually with indications of four dark spots near its apex and a pair near the posterior margin; pronotum sometimes with indications of darker irrorations; scutellum with the basal triangles faintly orange; forewing hyaline, tinged with green or whitish, sometimes almost or wholly pale, sometimes with the veins brown and with small brown cross-lines or spots. The genitalic characters are distinctive.

Apparently locally common in the southern parts of British Columbia, Alberta, and Saskatchewan. Host plant: *Artemisia* sp.

2. *Mesamia nigridorsum* (Ball) (Figs. 341, 661, 1102).—Length: 4.5-5.5 mm. Vertex and thorax yellowish, heavily marked with brown and blackish-brown; forewings white with the markings dark brown or blackish-brown. The markings and the genitalic characters are distinctive.

Widely distributed and apparently locally common in the southern parts of Alberta, Saskatchewan, Manitoba, and Ontario.

3. *Mesamia straminea* Osb. (Figs. 342, 662).—Length: 5.5 mm. Ochreous-yellow with the spots near the apex of the vertex blackish-brown and the basal triangles of the scutellum orange; forewing pale brownish with whitish areas and the veins brown. The markings and the genitalic characters are distinctive (male not figured).

Southern Alberta.

### Genus 10. *Twiningia* Ball

### Key to species of *Twiningia*

Largely yellowish-white, with brown markings ..... *fasciata*

Almost wholly brown ..... *pellucida*

*Twiningia fasciata* Beam. (Figs. 344, 663, 1103).—Length: 4.5 mm. Yellowish-white with the markings brown; forewings white with brown markings. The colour and markings and the genitalic characters are distinctive.

Southern British Columbia. Host plant: probably sagebrush.

*Twiningia pellucida* (Ball) (*irrorata* Osb., *plana* Van D.) (Figs. 345, 664, 1104).—Length: 5.0-5.5 mm. Brown, with dark brown lines bordering the anterior margin of the vertex and rounded, pellucid, whitish areas in the cells of the forewing. The genitalic characters are distinctive. The species resembles superficially species of *Scaphytopius* (*Cloanthanus*) but is readily distinguished by the gena not being visible behind the eye when viewed from above.

Southern British Columbia.

### Genus 11. *Fitchana* Oman

*Fitchana vitellina* (Fitch) (Figs. 346, 665, 1105).—Length: 5.0-6.0 mm. Bright yellow with the pronotum suffused with yellow-brown and the basal triangles of the scutellum brown; forewing whitish-hyaline, the cells broadly margined internally with light yellowish-brown and with an oblique, brown, transverse band from the apex of the clavus. The colour and markings and the genitalic characters are distinctive.

Widely distributed in the southern parts of British Columbia, Alberta, Saskatchewan, Manitoba, Ontario, and Quebec.

### Genus 12. *Bandara* Ball

Specific characters are primarily in the genitalia. The genus was revised by Knull (1946).

**Key to species of *Bandara***

Aedoeagus with a single pair of apical processes; posterior margin of female seventh sternum with a pair of slender median processes ..... *johnsoni*

Aedoeagus with two pairs of apical processes; posterior margin of female seventh sternum with a pair of broad median processes ..... *parallela*

*Bandara parallela* Knull (Figs. 347, 666, 1106).—Length: 4.5-5.5 mm. Light brown, the anterior margin of the vertex yellow and with three pairs of black spots, the pronotum with five silvery-whitish, longitudinal bands, and the scutellum with a yellow spot at either side; forewing hyaline with much of the clavus, an indefinite, transverse band on the corium at the apex of the clavus, and the greater part of the veins dark brown. The genitalic characters are distinctive.

Southern Quebec and New Brunswick. Host plant: probably birch.

*Bandara johnsoni* (Van D.) (Figs. 348, 667, 1107).—Length: 4.5-5.5 mm. Colour characters as in *B. parallela*. The genitalic characters are distinctive.

Southern Quebec and New Brunswick.

**Genus 13. *Aligia* Ball**

This genus was revised by Hepner (1942).

*Aligia jucunda* (Uhl.) (Figs. 349, 668).—Length: 6.0 mm. Pale greyish-ochreous with the basal triangles of the scutellum orange-brown and the other dark markings of the body and forewings dark brown. The colour and markings and the genitalic characters are distinctive.

Southern British Columbia. Host plant: oak.

**Genus 14. *Norvellina* Ball**

Identification of species is on a basis of colour, markings, and genitalic characters. The genus was revised by Lindsay (1940).

**Key to species of *Norvellina***

1. Vertex and pronotum yellow or whitish, with weak or no dark markings; forewing with a broad, dark brown, transverse band beyond middle and with its basal half not or only weakly dark-marked ..... 2

   Vertex, pronotum, and basal region of forewing closely irrorated with black ..... 3

2. Aedoeagus very long, apex roundedly expanded in lateral view, paraphyses longer than shaft; female seventh sternum without a median tooth ..... 2. *novica*

   Aedoeagus shorter, apex not roundedly expanded in lateral view, paraphyses shorter than shaft; female seventh sternum with a median tooth ..... 1. *seminuda*

3. Forewing with costal region contrastingly paler than clavus ..... 4. *curvata*

   Forewing with costal region not contrastingly paler than clavus, and with dark transverse bands at base and beyond middle ..... 3. *chenopodii*

1. *Norvellina seminuda* (Say) (Figs. 350, 669, 1108).—Length: 4.0-5.0 mm. Vertex whitish-ochreous; pronotum whitish with faint brown irrorations; scutellum whitish-ochreous with the basal triangles yellowish-brown and the median area irrorated with brown; forewing white with the markings brown. The genitalic characters are distinctive and distinguish the species from *novica*. A subspecies of *seminuda* or a closely related species, *scitula* Ball, may occur in British Columbia.

Widely distributed in the southern parts of British Columbia, Saskatchewan, Ontario, and Quebec. Host plants: common chickweed and amaranthus. There are two broods per annum.

2. *Norvellina novica* Med. (Figs. 351, 670, 1109).—Length: 4.5-5.5 mm. Colour and markings as in *N. seminuda*, from which it can be distinguished by the genitalic characters and the often larger size.

Widely distributed in the southern parts of Manitoba, Ontario, and Quebec.

3. *Norvellina chenopodii* (Osb.) (Figs. 352, 671, 1110).—Length: 5.0-5.5 mm. Vertex and thorax ochreous-yellow, usually largely suffused and irrorated

with reddish-brown; forewings ochreous-whitish with the markings brown. The colour and markings are distinctive.

Widely distributed in the southern parts of British Columbia, Alberta, Saskatchewan, Manitoba, Ontario, and Quebec. Host plant: lamb's-quarters. There are two broods per annum.

4. *Norvellina curvata* Linds. (Figs. 353, 1111).—Length: 5.0 mm. Vertex and thorax pale ochreous with the markings brown, the scutellum with a greyish-white tinge; forewings greyish-white with the markings brown. The colour and markings are distinctive.

Southern British Columbia.

### Genus 15. *Paraphlepsius* Bak.

Members of this genus are rather large in size and relatively uniform in colour and markings. The vertex and thorax are dark brown or brown, closely irrorated with rounded ochreous spots that are often more or less confluent. The forewing is whitish with the veins brown or dark brown and with numerous small dots that usually are arranged as to form numerous vermiculate markings. Specific characters are largely in the aedoeagus and pygofer of the male and in the female seventh sternum. The genus was revised by Crowder (1952).

#### Key to species of *Paraphlepsius*

1. Aedoeagus with a pair of processes arising from its base and extending about to the apex of the shaft ..... 2
   Aedoeagal processes absent or not reaching beyond middle of shaft ..... 3
2. Apical third of aedoeagus recurved downward ..... 1. *lascivius*
   Aedoeagus not recurved ..... 2. *collitus*
3. Aedoeagus long, tapered, curved downward ..... 4
   Aedoeagus various but not as above ..... 7
4. Basal region of aedoeagus with a pair of slender, posteriorly directed processes ..... 3. *solidaginis*
   Basal region of aedoeagus without such processes ..... 5
5. Aedoeagus asymmetrical, its basal region with a blunt, tapering, posteriorly directed process ..... 5. *occidentalis*
   Aedoeagus not as above ..... 6
6. Pygofer with an upturned, tapering spine at apex ..... 6. *eburneolus*
   Pygofer with a posteriorly directed digitate process at apex ..... 4. *humidius*
7. Aedoeagus long, tapering, strongly curved upward ..... 8
   Aedoeagus not as above ..... 10
8. Aedoeagus simple, without processes ..... 13. *punctiscriptus*
   Aedoeagus with processes at apex ..... 9
9. Aedoeagus symmetrical, with a single pair of processes at apex; pygofer with a long, stout spine posteriorly ..... 11. *dentatus*
   Aedoeagus asymmetrical, one side of apex produced as a short spine, the other as a long, forked process; pygofer without a long, stout, posterior spine but with a short, ventral tooth ..... 12. *strobi*
10. Aedoeagus rounded or pointed at apex, not bifurcate, in ventral view; pygofer with a long spine arising from postero-ventral corner and directed outward and upward ..... 13
    Aedoeagus bifurcate at apex in ventral view; pygofer not as above ..... 11
11. Apical region of pygofer with two spines, one dorsal and the other at the apex and directed ventrally ..... 15. *bifidus*
    Apical region of pygofer with a single spine ..... 12
12. Spine of pygofer directed posteriorly ..... 16. *turpiculus*
    Spine of pygofer curved to point dorsally ..... 14. *fulvidorsum*
13. Aedoeagus tapered and sharply pointed at apex in ventral view ..... 7. *apertinus*
    Aedoeagus rounded or bluntly pointed at apex in ventral view ..... 14
14. Aedoeagus short and stout, with apex hooked downward in lateral view ..... 9. *apertus*
    Aedoeagus longer and more slender, with apex distinctly curved upward in lateral view 15
15. Aedoeagus with a blunt ventral projection near base ..... 8. *excavatus*
    Aedoeagus without such projection ..... 10. *irroratus*

1. *Paraphlepsius lascivius* (Ball) (*micronotatus* Osb. & Lath.) (Figs. 354, 672, 1112).—Length: 5.0-6.0 mm. A rather robust insect with the head and thorax similar to the forewings in general colour. There are usually two dark brown areas at the anterior margin of the vertex, but otherwise the species is coloured rather uniformly. The genitalic characters are distinctive.

Widely distributed and locally common in the southern parts of British Columbia, Alberta, and Saskatchewan.

2. *Paraphlepsius collitus* (Ball) (Figs. 355, 673, 1113).—Length: 5.0-6.0 mm. The vertex and thorax are largely ochreous and contrast with the general greyish-brown hue of the forewings. The dark markings of the forewings are intensified at base and middle to form indefinite dark transverse bands. The genitalic characters are distinctive.

Southern Ontario, southern Quebec, New Brunswick, and Nova Scotia.

3. *Paraphlepsius solidaginis* (Walk.) (*nebulosus* Van D.) (Figs. 356, 674, 1114).—Length: 7.0-8.0 mm. A large species with the vertex and thorax more or less concolorous with the forewings. The curved, darkened band on each forewing and the genitalic characters are distinctive.

Southern British Columbia (at 6,000 feet), grassland regions of Alberta, Saskatchewan, and Manitoba, and Nova Scotia.

4. *Paraphlepsius humidus* (Van D.) (Figs. 357, 675, 1115).—Length: 7.0 mm. A robust species with the vertex and scutellum distinctly more ochreous than the forewings and the greater part of the thorax; the basal third of the forewing is rather less heavily dark-marked than the remainder. The genitalic characters are distinctive.

Southern Ontario and southern Quebec.

5. *Paraphlepsius occidentalis* (Bak.) (Figs. 358, 676, 1116).—Length: 5.0-6.0 mm. A rather uniform species in general colour. The genitalic characters are distinctive. There is some variation in the degree of curvature of the shaft of the aedoeagus and in the size of its posterior basal processes.

Widely distributed in southern British Columbia and the mountain districts of Alberta.

6. *Paraphlepsius eburneolus* (Osb. & Lath.) (Figs. 359, 677, 1117).—Length: 5.0-6.0 mm. The ochreous head and thorax contrast with the dark brown general hue of the forewings. The genitalic characters are distinctive.

Southern Saskatchewan.

7. *Paraphlepsius apertinus* (Osb. & Lath.) (Figs. 360, 678, 1118).—Length: 6.0-7.0 mm. The general ochreous colour of the head and thorax contrasts somewhat with the more greyish-brown general colour of the forewings. The dark markings of the forewing are intensified at the base, at the middle of the clavus, and in the apical region to form indefinite transverse bands. The genitalic characters are distinctive.

Widely distributed in southern British Columbia and the mountain districts of Alberta. It is a vector of California aster yellows.

8. *Paraphlepsius excavatus* Crowd. (Figs. 361, 679, 1119).—Length: 6.0-7.0 mm. The largely ochreous vertex and scutellum contrast somewhat with the greyish-brown general colour of the forewings. This species resembles *apertinus* and *collitus* in colour and markings. The genitalic characters are distinctive.

Southern British Columbia.

9. *Paraphlepsius apertus* (Van D.) (Figs. 362, 680, 1120).—Length: 5.0-6.0 mm. The vertex and pronotum are more or less concolorous with the forewings.

The dark markings of the forewing are sometimes intensified at base, middle, and apex to form indefinite transverse bands. The genitalia are distinctive.

This species has a mainly Boreal and mountain distribution. Alaska, British Columbia (up to 4,500 feet), Yukon, Northwest Territories, Alberta, Saskatchewan, Manitoba, Quebec, and Labrador.

10. *Paraphlepsius irroratus* (Say) (*testudinarius* Burm.) (Figs. 363, 681, 1121).—Length: 5.5-6.0 mm. A rather slender insect, rather uniform in colour but sometimes with the vertex and scutellum paler than the pronotum and forewings. The genitalic characters are distinctive. There is some variation, apparently geographical, in the form of the aedoeagus, and there are indications of host plant differences in different areas. It is possible that this may be a complex of two or more species that are ill-defined morphologically.

Southern British Columbia and southern Alberta, widely distributed and locally common in southern Ontario and southern Quebec, and northern Quebec and Labrador.

11. *Paraphlepsius dentatus* (Bak.) (Figs. 364, 683).—Length: 7.0 mm. A rather robust insect with the vertex and scutellum distinctly paler than the forewings. The genitalic characters are distinctive (male not figured).

Southern Ontario and southern Quebec.

12. *Paraphlepsius strobi* (Fitch) (*uhleri* Van D., *franconianus* Ball) (Figs. 365, 684, 1124).—Length: 5.0-5.5 mm. A strongly marked insect with the head and thorax cinereous-brown and the markings of the forewing concentrated to form cinereous-brown transverse bands at base, middle, and apex. The genitalic characters are distinctive.

British Columbia and Quebec and probably throughout the Boreal Forest Region. Host plant: pine.

13. *Paraphlepsius punctiscriptus* (Van D.) (Figs. 366, 1125).—Length: 6.5 mm. A rather light-coloured insect with ochreous vertex and thorax and ochreous-greyish forewings. The markings of the forewings tend to be concentrated to form indistinct transverse bands at base and middle. The genitalic characters are distinctive.

Southern Manitoba.

14. *Paraphlepsius fulvidorsum* (Fitch) (Figs. 367, 682, 1122).—Length: 6.5 mm. The ochreous-yellow head and thorax contrast with the dark brown general colour of the forewings. This species resembles *collitus* in general appearance. The genitalic characters are distinctive.

Widely distributed in southern Ontario and southern Quebec.

15. *Paraphlepsius bifidus* (Sand. & DeL.) (Figs. 368, 685, 1126).—Length: 6.0-6.5 mm. A rather robust insect, fairly uniform in general colour. The genitalic characters are distinctive.

Widely distributed, but apparently local, in the southern parts of British Columbia, Saskatchewan, Ontario, and Quebec.

16. *Paraphlepsius turpiculus* (Ball) (Figs. 369, 686, 1127).—Length: 5.5-6.0 mm. A rather robust insect with a cinereous tinge and with the vertex and thorax more or less concolorous with the forewings. The genitalic characters are distinctive.

Locally common in the southern parts of Saskatchewan and Manitoba.

### Genus 16. *Texananus* Ball, subgenus *Texananus*

Rather large, robust species distinguished primarily by characters of the internal male genitalia and female seventh sternum. The connective is extended

posteriorly beyond and below the base of the aedoeagus as a large, usually blade-like process. The genus was revised by Crowder (1952).

**Key to species of *Texananus (Texananus)***

1. Process of connective as a single shaft ..... 2
   Process of connective forked near base of aedoeagus in ventral view, each branch with a fan-like expansion in lateral view ..... 1. *oregonus*
2. Process distinctly curved downward at apical fourth in lateral view ..... 2. *decorus*
   Process slightly or strongly curved upward in lateral view ..... 3
3. Process relatively stout, strongly tapering in ventral view, strongly curved upward in lateral view; style with a short projection from inner margin before apex ..... 5. *proximus*
   Process more slender, blade-like, only weakly tapering in ventral view, only weakly curved upward in lateral view; style without such projection ..... 4
4. Process longer, slightly expanded on apical third in lateral view; aedoeagus not strongly recurved ..... 3. *marmor*
   Process shorter, distinctly expanded on apical fourth in lateral view; aedoeagus strongly recurved ..... 4. *arctostaphylae*

1. *Texananus* (*Texananus*) *oregonus* (Ball) (*manus* DeL.) (Figs. 370, 1128).—Length: 6.5 mm. Vertex and thorax brownish-ochreous with the markings brown and fuscous; forewings whitish-ochreous with the markings dark brown. The internal male genitalia are distinctive.

Southern British Columbia. It is a vector of California aster yellows.

2. *Texananus* (*Texananus*) *decorus* (Osb. & Ball) (Figs. 371, 687, 1129).—Length: 6.5 mm. Vertex and thorax ochreous, heavily marked with brown and fuscous; forewings ochreous-whitish with the markings dark brown. The internal male genitalia and the female seventh sternum are distinctive.

Southern Ontario. Host plant: probably hazel.

3. *Texananus* (*Texananus*) *marmor* (Sand & DeL.) (Figs. 372, 688, 1130).—Length: 5.5-6.0 mm. Vertex and scutellum ochreous-yellow with the markings brown; pronotum largely dull whitish-ochreous or greyish-ochreous but broadly ochreous-yellow along the anterior margin where there are heavy dark brown markings; forewings whitish with the veins and markings brown. The markings are more irregular than those of other species of the genus, giving this insect a more mottled appearance. The colour and markings and the relatively minor but constant characters of the internal male genitalia and the female seventh sternum are distinctive. It is possible that this species is conspecific with *cumulatus* (Ball); the specific differences are not strong and apparently intergrade.

Widely distributed and locally common in the southern parts of Alberta, Saskatchewan, and Manitoba. Host plant: possibly juniper.

4. *Texananus* (*Texananus*) *arctostaphylae* (Ball) (Figs. 373, 689, 1131).—Length: 5.5-6.5 mm. Vertex and thorax light brownish-ochreous with the markings brown; forewings dull greyish-white or ochreous-whitish with the veins and markings dark brown. The colour and markings and the genitalic characters are distinctive.

Widely distributed on hill grasslands in British Columbia and in the grassland regions of Alberta, Saskatchewan, and Manitoba.

5. *Texananus* (*Texananus*) *proximus* Crowd. (Figs. 374, 1132).—Length: 5.5 mm. Vertex and thorax ochreous with the markings brown and dark brown; forewings greyish-ochreous or whitish-ochreous with the markings dark brown. The internal male genitalia are distinctive.

Southern British Columbia.

### Genus 17. *Opsius* Fieb.

*Opius stactogalus* Fieb. (*tamaracis* Kirsch., *osborni* Ball) (Figs. 375, 690, 1133).—Length: 4.0-5.0 mm. Vertex and scutellum yellowish-green; pronotum

yellowish-green anteriorly, green posteriorly; forewing green with the appendix and apical cells light brownish, the costal region usually partly or largely whitish or greenish-white, and the wings with small rounded whitish or greenish-white, areas and often with a few minute, black dots. The colour and markings and the genitalia are distinctive.

Southern Ontario. Host plant: *Tamarix* spp. Very common and sometimes injurious to the host plant.

### Genus. 18. *Fieberiella* Sign.

*Fieberiella florii* (Stal) (Figs. 376, 691, 1134).—Length: 7.0-7.5 mm. Ochreous brown or greyish-brown, with the apices of the claval and apical veins dark brown and the entire body and forewings closely covered with small, dark dots. These dots and the genitalic characters are distinctive.

Widely distributed in southern Ontario. The species was introduced from Europe; eggs have been found in plum rootstock imported from France. Host plants: plum, currant, sour cherry, privet, spiraea, and probably other plants. It is a vector of California aster yellows and of Western X-disease of peach and cherry.

### Genus 19. *Cicadula* Zett. (*Cyperacea* DeL.)

Moderate-sized, usually yellowish or yellowish-green insects without dark markings other than black dots on the vertex. They have mainly Boreal distributions and are often common in marshy situations. The host plants probably are sedges. Specific characters are primarily in the male genitalia and female seventh sternum. The genus was revised by Beirne and Young (1953).

#### Key to species of *Cicadula*

1. Vertex, pronotum, and scutellum with three longitudinal, brownish or reddish bands ..... 3. *cyperacea*
   Vertex without such bands ..... 2
2. Vertex with an unbroken black band across anterior margin ..... 1. *smithi*
   Vertex with black spots or a broken black band across anterior margin ..... 3
3. Males ..... 4
   Females ..... 9
4. Apical region of aedoeagus trifurcate ..... 5
   Apical region of aedoeagus simple ..... 6
5. Pygofer with a spine-like process arising from upper margin before apex and a downwardly-directed spine-like process at apex ..... 7. *quinquenotata*
   Pygofer without such processes ..... 8. *longiseta*
6. Pygofer expanded at apex ..... 6. *straminea*
   Pygofer more or less tapered at apex, not expanded ..... 7
7. Aedoeagus weakly sinuate, more nearly straight, with longer basal portion 2. *melanogaster*
   Aedoeagus evenly curved, with shorter basal portion ..... 8
8. Aedoeagus shorter and more nearly straight ..... 5. *intermedia*
   Aedoeagus longer and more distinctly curved ..... 4. *ciliata*
9. Seventh sternum with a band of longitudinal striae across posterior margin 5. *intermedia*
   Seventh sternum with two striated areas or without striae ..... 10
10. Seventh sternum without striae ..... 11
    Seventh sternum with distinct striae ..... 12
11. Seventh sternum with posterior margin deeply excavated and with a median projection ..... 7. *quinquenotata*
    Seventh sternum with posterior margin almost straight ..... 8. *longiseta*
12. Seventh sternum with posterior margin strongly excavated at each postero-lateral corner, and with two longitudinal striae from each of which shorter striae diverge postero-laterally ..... 2. *melanogaster*
    Seventh sternum not or not strongly excavated at postero-lateral corners, and with two rounded striated areas ..... 13

13. Striae of seventh sternum prominent, more or less radiating from a raised prominence; usually large species, 5.0-6.8 mm. long ..... 6. *straminea*
Striae of seventh sternum less prominent, not radiating from a raised prominence; usually smaller species, 4.8-5.5 mm. long ..... 4. *ciliata*

1. *Cicadula smithi* (Van D.) (*vittipennis* Sand. & DeL.) (Figs. 378, 692, 1137).—Length 5.0-6.0 mm. Yellowish-green with the band of the vertex black. The genitalic characters are distinctive.

British Columbia, mountain districts of Alberta, southern and northern Manitoba, southern Ontario, and southern Quebec.

2. *Cicadula melanogaster* (Prov.) (Figs. 379, 693, 1135).—Length: 4.2-5.0 mm. Yellowish or greenish-yellow with the spots black. The aedoeagus, male pygofer, and female seventh sternum are distinctive.

Widely distributed in southern Ontario and southern Quebec.

3. *Cicadula cyperacea* (Osb.) (Figs. 377, 694, 1138).—Length: 5.0-6.8 mm. Pale brownish-ochreous with black markings at the anterior margin of the vertex and with the longitudinal bands of the vertex and thorax some shade of red or brown. There is variation in general colour, in intensity of the dark bands, and in the extent of the dark areas of the female seventh sternum. The markings and the genitalic characters are distinctive.

Southern Ontario.

4. *Cicadula ciliata* (Osb.) (Figs. 380, 695, 1136).—Length: 4.8-5.5 mm. The general colour varies from greenish-yellow to orange-yellow or tawny; the spot behind each ocellus sometimes is large and rounded and sometimes is absent, and the median dark markings of the vertex sometimes are absent. There is some variation in the shape of the female seventh sternum and in the length, size, and number of striae. The genitalic characters are distinctive.

Widely distributed, mainly in the western part of the Boreal Region. Alaska, British Columbia (up to 3,200 feet), Northwest Territories, Alberta, Saskatchewan, and Manitoba.

5. *Cicadula intermedia* (Boh.) (*lunulifrons* Sahlb., *eruca* DeL., *montula* DeL.) (Figs. 381, 696, 1140).—Greenish-yellow with the spots black. The black spots of the vertex margin frequently are more or less confluent; the spot behind each ocellus frequently is large and rounded and sometimes is absent; the markings, on the centre of the vertex usually are as a pair of parallel lines but frequently are reduced to a pair of spots near the anterior margin and sometimes are absent; the pronotum sometimes is marked with brownish and the scutellum with black; and the forewings sometimes are suffused with brown or fuscous between the veins. The female seventh sternum is distinctive. As compared with *ciliata*, the aedoeagus is shorter and more straight, the style is less distinctly tapered towards its apex, and the lower margin of the pygofer is distinctly bluntly angled before its apex.

This species has a mainly western and northern distribution. Alaska, British Columbia, Yukon, Northwest Territories, mountains of Alberta, northern Manitoba, and northern Quebec.

6. *Cicadula straminea* (Sand. & DeL.) (*pollicarius* Ball, *wanakena* Ball, *stylata* DeL., *gesa* DeL., *ossiannilssoni* Kont.) (Figs. 382, 697, 1139).—Length: 5.0-6.8. Pale yellow to tawny with the spots of the vertex black. These spots sometimes are reduced and sometimes are enlarged and confluent; occasionally there is a small black spot behind each ocellus, a pair of small spots on the disc of the vertex, or, particularly in females from northern localities, the forewings are more or less suffused with brown. The male genitalia, notably the apical

region of the pygofer, are distinctive. The female seventh sternum resembles that of *ciliata* but the grooves are deeper and the ridges more prominent and radiate from a more distinctly raised protruberance.

Widely distributed, mainly in the Boreal Region. Alaska, British Columbia, Yukon, Northwest Territories, Alberta, Saskatchewan, northern and southern Manitoba, southern Ontario, and New Brunswick.

7. *Cicadula quinquenotata* (Boh.) (*nigricornis* Sahlb., *decipiens* Prov., *aurantipes* Edw., *persimilis* Edw.) (Figs. 383, 698, 1141).—Length: 4.5-5.5 mm. Yellowish-green. The black spots of the vertex margin vary in size; the spot behind each ocellus sometimes is large and occasionally is absent or only feebly indicated. The scutellum is sometimes marked with black. The two spots on the vertex margin are rather distinctive, as other species of the genus usually have four. The genitalic characters are distinctive.

Widely distributed, mainly in the Boreal Region and the mountains. Alaska, British Columbia, Northwest Territories, Alberta, Saskatchewan, Manitoba, Ontario, Quebec, and Labrador.

8. *Cicadula longiseta* (Van D.) (Figs. 384, 699, 1142).—Length: 3.8-4.5 mm. Yellowish-green. Occasionally there is a small black spot behind each ocellus and occasionally the scutellum is marked with black. The genitalic characters are distinctive.

Widely distributed in southern British Columbia and western Alberta.

### Genus 20. *Calanana* DeL.

*Calanana rubralineata* (Beam.) (Figs. 385, 700, 1143).—Length: 3.0-3.25 mm. Stramineous, with the median line of the vertex reddish and the other dark markings of the vertex and thorax brown; forewing hyaline ochreous, suffused with brownish between the veins, which are yellow. The genitalic characters are distinctive.

Southwestern British Columbia. Host plants: probably sedges or grasses.

### Genus 21. *Paluda* DeL.

This species may be distinguished from species of *Cicadula*, which it resembles, by the absence of black spots on the vertex margin, as well as by the genitalic characters. The species were discussed by DeLong (1937).

*Paluda gladiola* (Ball) (*mella* Sand. & DeL., *placida* Osb., *placata* Bak.) (Figs. 386, 701, 1144).—Length: 4.5-5.0 mm. Greenish-yellow or orange-yellow, without dark markings.

Southern British Columbia in mountain districts, southern Manitoba, and New Brunswick. It occurs in marshy situations. Host plants: probably sedges.

### Genus 22. *Elymana* DeL. (*Solenopyx* Rib.)

Yellowish-green insects that resemble superficially species of *Cicadula* but that lack the dark spots on the vertex and have distinctive genitalic characters. The species were discussed by DeLong (1936). The host plants probably are sedges. Specific characters are in the male genitalia.

#### Key to species of *Elymana*

1. Male pygofer with a single spine, at apex ..... 1. *virescens*
   Male pygofer with a spine on the dorsal margin in addition to the apical spine ..... 2
2. Dorsal spine inside margin of pygofer, not visible in lateral view ..... 3. *caduca*
   Dorsal spine on margin of pygofer and visible in lateral view ..... 2. *acrita*

1. *Elymana virescens* (Fab.) (*sulphurellus* Zett., *inornata* Van D., *?ritana* DeL.) (Figs. 387, 702, 1145).—Length: 4.5-5.5 mm. Pale yellowish-green without dark markings; forewings greenish-hyaline with the veins yellowish. The genitalic characters are distinctive. There is some geographical variation in

that specimens from British Columbia have the upper margin of the pygofer more nearly straight and less distinctly ornamented with minute spines than specimens from the East; specimens from the Prairie Provinces are intermediate.

Widely distributed and locally abundant in the southern parts of British Columbia, Alberta, Saskatchewan, and Quebec, and found in New Brunswick.

2. *Elymana acrita* DeL. (Figs. 388, 703, 1146).—Length: 4.5-5.0 mm. Yellowish-green without definite dark markings; forewings greenish-hyaline with the veincs yellowish. The male pygofer is distinctive.

Mountain districts of British Columbia, Northwest Territories, mountain districts of Alberta, and southern Saskatchewan.

3. *Elymana caduca* DeL. (Figs. 389, 704, 1147).—Length: 5.0-5.5 mm. Yellowish-green without definite markings; forewings greenish-hyaline with the veins yellowish. The male pygofer is distinctive.

Southern British Columbia, southern Ontario, and northern Quebec.

### Genus 23. *Euscelis* Brulle

*Euscelis obsoletus* (Kirsch.) (*convexus* Kirsch., *sejungendus* Kirsch., *sexpunctatus* Sahlb.) (Figs. 390, 705, 1148).—Length: 5.0-5.5 mm. Stramineous, with brown markings that frequently are faint or absent. There is variation in the wing-length. The aedoeagus is distinctive.

Southwestern British Columbia. Records for this species published before 1952 probably refer to species of related genera.

### Genus 24. *Macustus* Rib.

*Macustus grisescens* (Zett.) (*alpinus* Ball) (Figs. 391, 706, 1149).—Length: 4.5-5.5 mm. Stramineous, with brownish bands on the vertex, traces of fuscous bands on the pronotum and scutellum, and sometimes weak fuscous markings between the veins of the forewings. The forewings usually are shorter than the abdomen in the female, but a long-winged form occurs occasionally. The genitalic characters are distinctive.

This species appears to have a mainly northern and mountain distribution. Alaska, British Columbia, (up to 5,000 feet), northern Manitoba, and the Boreal Region of Quebec. Host plants: probably sedges or grasses.

### Genus 25. *Thamnotettix* Zett. (*Thamnus* Fieb.)

*Thamnotettix confinis* (Zett.) (*prasina* auctt., *simplex* H.-S., *prominulus* Reut., *chlamydatus* Prov., *infuscatus* Gill. & Bak., *punctiscutus* Gill. & Bak.) (Figs. 392, 707, 1150).—Length 5.0-6.5 mm. Greenish-yellow or greenish-brown with the markings brownish or fuscous. There is much variation in the dark markings; normally the forewings are more or less suffused with brownish between the veins but some specimens are wholly pale and others are largely dark fuscous. In dark specimens the pronotum and scutellum may be suffused with fuscous or brownish. The genitalic characters are distinctive. On a basis of external characters this species often resembles some species of *Chlorotettix*, but can be distinguished by the genitalia.

Widely distributed and locally common in grasslands in the Boreal Region. Alaska, British Columbia (up to 6,000 feet), Yukon, Alberta, Saskatchewan, Manitoba, Ontario, Quebec, Nova Scotia, and Labrador. Its distribution extends northward to the tree line. Host plants: probably grasses or sedges.

### Genus 26. *Doliotettix* Rib.

*Doliotettix pallens* (Zett.) (*lapponicus* Haupt.) (Figs. 393, 1151).—Length: 6.0 mm. Yellow with the markings of the body brown; forewing hyaline brownish-yellow with the costa yellow. The genitalic characters are distinctive.

Alaska.

### Genus 27. *Euscelidius* Rib.

*Euseclidius schenki* (Kirsch.) (*maculipennis* DeL. & Dav.) (Figs. 394, 708, 1152).—Length: 5.0-6.0 mm. Ochreous with the markings blackish-fuscous. There is variation in the development of the dark markings. The relatively long forewings and the generally mottled appearance distinguish this species from its allies. The male genitalia are distinctive.

Southern British Columbia, on dry hill grasslands. It is a vector of California aster yellows.

### Genus 28. *Streptanus* Rib.

There has been much confusion between species of this genus in the past. Specific characters are in the form of the aedoeagus. The host plants probably are grasses or sedges. The species are found near the roots of these plants. The genus was revised by Beirne (1954).

#### Key to species of *Streptanus*

1. Aedoeagus with one or two dorso-lateral projections near base of shaft ..... 2
   Aedoeagus without such projections ..... 3
2. Expanded apical region of aedoeagus obviously longer than wide; shaft with two dorso-lateral projections near base ..... 1. *sordidus*
   Expanded apical region of aedoeagus not longer than wide; shaft with a single dorso-lateral projection near base ..... 2. *aemulans*
3. Expanded apical region of aedoeagus as long as or longer than wide ..... 3. *confinis*
   Expanded apical region of aedoeagus much shorter than wide ..... 4. *marginatus*

1. *Streptanus sordidus* (Zett.) (*confusus* Kirsch., *fraterculus* Reut., *relativus* Gill. & Bak., *lindbergi* Bak.) (Figs. 395, 1154).—Length: 3.5-4.0 mm. Dull stramineous with the markings fuscous. The aedoeagus is distinctive.

Southern British Columbia, southern Ontario, and New Brunswick.

2. *Streptanus aemulans* (Kirsch.) (*minkii* Kirsch., *sahlbergi* Reut.) (Figs. 396, 397, 709, 1153).—Length: 4.0-5.5 mm. Dull stramineous with the markings blackish-fuscous. There are two forms. One has the forewings shorter than the abdomen in both sexes and is 4.0-4.5 mm. long, the body and forewings are heavily marked with blackish, and the dorso-lateral projection near the base of the shaft of the aedoeagus is usually rounded. The other has the forewings longer than the abdomen and is 5.0-5.5 mm. in length, the forewing is less heavily dark-marked, except along the costa, and the dorso-lateral projection near the base of the shaft of the aedoeagus is usually more distinctly pointed. The aedoeagus is distinctive.

The long-winged form has been found in Alaska, British Columbia, and Yukon and the short-winged form in Yukon.

3. *Streptanus confinis* (Reut.) (*deceptus* Sand. & DeL., *wagneri* Oss.) (Figs. 399, 710, 1156).—Length: 4.5-5.5 mm. Dull stramineous with weak fuscous markings. There are two forms. One has the forewings shorter than the abdomen in the female and is 4.5-5.0 mm. long and distinctly dark-marked. The other has the forewings longer than the abdomen in both sexes and is 5.0-5.5 mm. long and only weakly dark-marked, and sometimes almost wholly pale. The aedoeagus is distinctive.

The long-winged form has been found in the southern parts of British Columbia (up to 7,300 feet), Alberta, Manitoba, and Ontario, and the short-winged form in British Columbia, Northwest Territories, southern Alberta, southern Ontario, northern Quebec, and Labrador.

4. *Streptanus marginatus* (Kirsch.) (*brevipennis* Kirsch., *similis* Kirsch., *hyperboreus* Van D.) (Figs. 398, 711, 1155).—Length: 3.5-4.5 mm. Dull stramineous with variable blackish-fuscous markings. The forewings are shorter

than the abdomen in the female. The relatively small size and the unbroken transverse band of the vertex are rather distinctive, though species of *Coulinus* have the latter character. The aedoeagus is distinctive.

Apparently locally common in the Subarctic of the Northwest. Alaska, Yukon, and Northwest Territories.

### Genus 29. *Coulinus* Beir.

On a basis of external characters members of this genus resemble species of *Streptanus*. The genitalia show the best specific characters. The known species are confined to the Subarctic, and were discussed by Beirne (1954).

#### Key to species of *Coulinus*

Larger species, 4.5-5.25 mm. long; aedoeagus with a pair of subterminal spine-like processes; female seventh sternum with posterior margin emarginate at either side of a rounded median projection ..... *uladus*

Smaller species, 3.5-4.0 mm. long; aedoeagus without subterminal processes; female seventh sternum with posterior margin sloping from either side to a median, incised projection ..... *usnus*

*Coulinus uladus* Beir. (Figs. 401, 712, 1157).—Length: 4.5-5.25 mm. Light brownish-ochreous with the markings fuscous or black. The forewings are shorter than the abdomen in the female. The genitalic characters are distinctive.

Widely distributed in Alaska and found also in northern Manitoba and northern Quebec.

*Coulinus usnus* Beir. (Figs. 402, 713, 1158).—Length: 3.5-4.0 mm. Light brownish-ochreous with the markings brown, fuscous, or blackish. There is much variation in the extent and intensity of the dark markings, particularly those of the forewings. The genitalic characters are distinctive.

Apparently widely distributed and locally common in Alaska, Yukon, and Northwest Territories.

### Genus 30. *Extrusanus* Oman

*Extrusanus extrusus* (Van D.) (*venosus* Osb.) (Figs. 400, 714, 1160).—Length: 4.0-4.5 mm. Stramineous with brown or fuscous markings. There is much variation. The markings may be faint or absent, whereas at the other extreme the body is heavily dark-marked and the forewings are wholly fuscous between the veins. Normally the forewings are shorter than the abdomen in the female and as long as the abdomen in the male but a rarer form has the forewings longer than the abdomen in both sexes. The genitalic characters are distinctive.

Widely distributed in the southern and Boreal regions of Alberta, Saskatchewan, Manitoba, Ontario, Quebec, and Nova Scotia. Host plants: probably grasses.

### Genus 31. *Frigartus* Oman

*Frigartus frigidus* (Ball) (Figs. 403, 715, 1159).—Length: 3.25-4.0 mm. Head and thorax ochreous with the spots black; forewings greyish-stramineous with the claval suture fuscous and with fuscous streaks in the cells. The markings of the vertex and the genitalic characters are distinctive.

Widely distributed in the grassland regions of Alberta and Saskatchewan. Host plant: prairie-sagewort.

### Genus 32. *Athysanus* Burm.

*Athysanus argentarius* Metc. (*argentatus* Fab.) (Figs. 404, 716, 1161).—Length: 7.0-8.0 mm. Stramineous, with the markings of the vertex and thorax black; forewing with the claval suture and commissure brown and the costal

region yellowish-white, and usually with brownish streaks between the veins. The colour and markings and the genitalic characters are distinctive.

An introduced European species that is spreading rapidly. It was first noticed in Canada in southern Ontario in 1940 and is now the most common of the large leafhoppers on grasses in southern Ontario and southern Quebec. It was found commonly as far north as Ste. Flore, Quebec, in 1951 and Quebec City in 1953. The extension of its range westward and into the Maritime Provinces might be anticipated. Host plants: grasses.

### Genus 33. *Limotettix* Sahlb. (*Drylix* Edw.)

Though the external characters show some degree of specificity the genitalia must be examined for reliable specific identifications. The genus was discussed by Dawson (1931). The host plants probably are grasses.

#### Key to species of *Limotettix*

1. Aedoeagus rounded in lateral view; posterior margin of female seventh sternum excavated from lateral corners ..... 2
   Aedoeagus elongate in lateral view; excavation of posterior margin of female seventh sternum not reaching lateral corners ..... 4
2. Style truncate at apex; excavation extending to half length of female seventh sternum ..... 1. *striolus*
   Inner angle of apex of style produced as a long process; excavation of female seventh sternum shallow, its depth less than half length of sternum ..... 3
3. Inner apical process of style straight, tapered, pointed; body and forewings heavily marked with blackish ..... 5. *nigrax*
   Inner apical process of style curved, rounded at apex; body and forewings usually not heavily marked with blackish ..... 2. *atricapillis*
4. Apex of aedoeagus curved anteriorly in lateral view; female seventh sternum with a deep median excavation with a smaller excavation at either side of it ..... 3. *uneolus*
   Apex of aedoeagus curved posteriorly in lateral view; female seventh sternum not as above ..... 5
5. Female seventh sternum with a median U-shaped excavation that is notched at its base ..... 4. *divaricatus*
   Female seventh sternum with a rounded excavation at either side of which the posterior margin is rounded ..... 6. *parallelus*

1. *Limotettix striolus* (Fall.) (*frenatus* Germ.) (Figs. 405, 717, 1162).—Length: 4.0-5.0 mm. Greenish-yellow with the markings of the vertex black; forewings hyaline green-yellow. The genitalic characters are distinctive. The female seventh sternum and the apical region of the style distinguish this species from *atricapillis*.

Alaska, and widely distributed and locally common in the southern parts of British Columbia, Alberta, Saskatchewan, Ontario, and Quebec.

2. *Limotettix atricapillis* (Boh.) (*utahnus* Laws., *?bisoni* Knull) (Figs. 406, 718, 1163).—Length: 4.5-5.5 mm. Greenish-yellow or brownish-yellow with the markings of the vertex black; forewings hyaline greenish-yellow, usually more or less tinged with brownish, and sometimes suffused with fuscous between the yellowish veins. The genitalic characters, notably the apical region of the style, are distinctive.

Alaska, Northwest Territories, and widely distributed and locally common in the southern parts of British Columbia and Saskatchewan.

3. *Limotettix uneolus* (Ball) (Figs. 407, 719, 1165).—Length: 4.0-5.0 mm. Greenish-yellow with the markings of the vertex black; forewings hyaline greenish-yellow, usually tinged with brownish-fuscous, with the veins yellow and the commissure and claval suture sometimes brown. The vertex is marked more heavily than is usual in related species. The genitalic characters are

distinctive. This species resembles *Scleroracus paludosus* on a basis of external characters.

British Columbia (at 7,300 feet), and the grassland regions of Alberta, Saskatchewan, and Manitoba.

4. *Limotettix divaricatus* (Sand. & DeL.) (Figs. 408, 720,).—Length: 5.5-7.0 mm. Yellowish or greenish-yellow with the markings of the vertex black; forewings hyaline greenish-yellow, sometimes weakly brownish between the yellow veins. A short-headed species, like *parallelus*, with distinctive genitalic characters (male not figured).

Southern Saskatchewan and southern Ontario.

5. *Limotettix nigrax* Med. (Figs. 409, 721, 1164).—Length: 5.5-6.0 mm. Yellow with the markings black; forewing dark brown or blackish with the veins, except those of the apical region, yellow. The colour and the apical region of the style are distinctive.

Southern Ontario.

6. *Limotettix parallelus* (Van D.) (Figs. 410, 722, 1166).—Length: 5.0-6.0 mm. Greenish-yellow with the markings of the vertex black; forewing strongly streaked with fuscous or brownish in the apical cells and between the yellowish veins. A rather distinctive feature is that the vertex is no longer at the middle than beside the eye. The genitalic characters are distinctive.

Southern Alberta, southern Ontario, and southern Quebec.

### Genus 34. *Scleroracus* Van D. (*Conogonus* Van D., *Ophiola* Edw.)

Species of the genus are rather uniform in general appearance and there is much variation in the extent of the dark markings of the body and forewings. The internal male genitalia must be examined for reliable identifications of most species. At time of writing the genus is under revision by J. T. Medler.

#### Key to species of *Scleroracus*

1. Forewing with at least the basal half of the inner discal cell bright yellow, and with the subapical cells black or largely black ..... 1. *varus*
   Forewing not as above, either with all cells blackish or margined with blackish internally, or without definite dark markings ..... 2
2. Upper region of male pygofer extended beyond apex of lower region and curved downward around it; forewings without extensive dark markings ..... 3
   Upper region of male pygofer shorter than the lower region; forewings usually with extensive dark markings ..... 4
3. Larger species, about 5.0 mm. long; forewing darkened only along commissure and sometimes along the claval suture ..... 12. *paludosus*
   Smaller species, length 4.0 mm. or less; forewing distinctly tinged with fuscous, especially on clavus ..... 13. *angustatus*
4. Apical processes of aedoeagus short and broad in posterior or postero-dorsal view ..... 5
   Apical processes of aedoeagus long, slender, and tapering in posterior or postero-dorsal view ..... 8
5. Each apical process of aedoeagus simple, without projections ..... 6
   Each apical process of aedoeagus with a lateral and an apical projection ..... 7
6. Each apical process of aedoeagus relatively long in postero-dorsal view, almost straight in lateral view ..... 5. *omani*
   Each apical process of aedoeagus relatively short in postero-dorsal view, curved downward at its base and upward near its apex in lateral view ..... 4. *dasidus*
7. Innermost of the two projections of each apical process of aedoeagus bifurcate; strongly-marked species, sometimes largely black ..... 3. *kryptus*
   Innermost of the two projections of each apical process simple, not bifurcate; often weakly-marked species, sometimes largely pale ..... 2. *vaccinii*
8. Each apical process of aedoeagus with a pointed lateral projection near its base in postero-dorsal view ..... 9
   Each apical process without such projection ..... 10

9. Lateral projection of base of apical process slender, digitate; usually heavily-marked, blackish species with the head largely black ..... 7. *corniculus*
Lateral projection of base of apical process short, stout; usually less heavily-marked species with head largely ochreous ..... 8. *osborni*
10. Apical processes of aedoeagus converging at their apices ..... 6. *uhleri*
Apical processes diverging at their apices ..... 11
11. Upper margin of male pygofer produced posteriorly as a digitate process ..... 12
Upper margin of male pygofer not produced as a digitate process ..... 11. *plutonius*
12. Aedoeagus in postero-dorsal view broadest at base of processes in lateral view with a rounded dorsal projection near apex. Eastern ..... 9. *finitimus*
Aedoeagus in postero-dorsal view broadest at middle of processes, in lateral view not with a rounded dorsal projection near apex. Western ..... 10. *melastigmus*

1. *Scleroracus varus* (Ball) (Figs. 411, 723).—Length: 5.0 mm. Vertex and thorax yellow with the markings black; forewing ochreous-whitish with the markings blackish and the veins and the basal half of the inner discal cell yellow. A rather robust species with distinctive markings.

Southern Manitoba and southern Ontario.

2. *Scleroracus vaccinii* (Van D.) (Figs. 412, 724, 1167).—Length: 5.0 mm. Vertex and thorax yellow with the markings black; forewing hyaline ochreous, tinged with brownish, with the markings fuscous. There is much individual variation in the extent of the dark markings of the body and forewings; some specimens are almost wholly pale. The aedoeagus is distinctive.

Widely distributed and locally abundant in acid bogs in southern Ontario, southern Quebec, New Brunswick, and Nova Scotia.

3. *Scleroracus kryptus* Med. (Figs, 413, 725, 1168).—Length: 4.0-4.5 mm. Vertex and thorax ochreous with the markings black; forewing hyaline brownish-ochreous with the markings fuscous or black. There is much individual variation in the extent of the dark markings; some specimens are almost wholly shining black whereas others are largely pale. A rather robust species with distinctive aedoeagus.

Southern Manitoba, southern Ontario, and southern Quebec.

4. *Scleroracus dasidus* Med. (Figs. 414, 726, 1169).—Length: 3.5-4.5 mm. Vertex and thorax ochreous with the markings black; forewings brownish-ochreous with the markings fuscous. There is much individual variation in the extent of the dark markings; some specimens are largely pale. The aedoeagus is distinctive.

Widely distributed in southern British Columbia and found also in southern Saskatchewan and southern Manitoba.

5. *Scleroracus omani* Med. (Figs. 415, 1170).—Length: 4.0 mm. Vertex and thorax ochreous with the markings black; forewings brownish-ochreous with markings fuscous. The aedoeagus is distinctive.

Southern Alberta.

6. *Scleroracus uhleri* (Ball) (Figs. 416, 727, 1171).—Length: 4.0-4.5 mm. Vertex and thorax ochreous-yellow with the markings black; forewings brownish-ochreous with the markings blackish. There is much individual variation in the extent of the dark markings; some specimens are almost wholly shining black. The aedoeagus is distinctive.

Widely distributed in the southern regions of Manitoba, Ontario, and Quebec.

7. *Scleroracus corniculus* (Marsh) (*instabilis* Van D., *intractabilis* Kont.) (Figs. 417, 729, 1172).—Length: 3.5-5.0 mm. Vertex and thorax ochreous-yellow with the markings black; forewings pale brownish with the markings blackish. A dark species with distinctive aedoeagus.

Widely distributed in the southern parts of British Columbia, Manitoba, Ontario, and Quebec.

8. *Scleroracus osborni* (Ball) (Figs. 418, 728, 1173).—Length 3.0-4.0 mm. Vertex and thorax ochreous-yellow with the markings black; forewings whitish-ochreous with the markings fuscous. There is much individual variation in the extent of the dark markings; some specimens have the forewings almost wholly pale. A rather light-coloured species, as compared with *corniculus*, with distinctive aedoeagus.

Widely distributed in the southern parts of British Columbia, Alberta, Saskatchewan, Manitoba, Ontario, and Quebec.

9. *Scleroracus finitimus* (Van D.) (Figs. 419, 1174).—Length: 4.5 mm. Vertex and thorax ochreous with the markings black and brown; forewings ochreous with the markings fuscous. There is variation in the extent of the dark markings. The aedoeagus, in conjunction with pygofer, is distinctive.

Southern British Columbia.

10. *Scleroracus melastigmus* Med. (Figs. 420, 1175).—Length: 3.5-4.0 mm. Head and thorax ochreous with the markings black; forewings whitish-ochreous with the markings fuscous. The aedoeagus, in conjunction with the pygofer, is distinctive.

Southern British Columbia, southern Manitoba, and southern Ontario.

11. *Scleroracus plutonius* (Uhl.) (*?arctostaphylus* Ball) (Figs. 421, 422, 730, 1176).—Length: 2.75-4.5 mm. Vertex and thorax ochreous-yellow with the markings black; forewings brownish-ochreous with the markings blackish. There is variation in the extent of the dark markings but in general this is a dark-coloured species. The aedoeagus is distinctive.

This species has a mainly Boreal and mountain distribution. Alaska, British Columbia, Northwest Territories, mountain districts of Alberta, and Manitoba, Ontario, and Quebec.

12. *Scleroracus paludosus* (Boh.) (Figs. 423, 731, 1177).—Length: 4.0-5.0 mm. Vertex and thorax ochreous-yellow with the markings black; forewing light brownish or yellowish-brown, usually with the commissure and the claval suture dark brown. On a basis of external characters this species resembles species of *Limotettix*, notably *uneolus*. The aedoeagus, in conjunction with the pygofer, is distinctive.

Widely distributed and apparently locally common in the southern regions of British Columbia, Alberta, Saskatchewan, and Manitoba.

13. *Scleroracus angustatus* (Osb.) (Figs. 424, 732, 1178).—Length: 3.5-4.0 mm. Head and thorax ochreous-yellow with the markings black; forewings brownish-ochreous, the cells more or less margined with fuscous internally especially in the claval region and along the commissure. The combination of the small size, the form of the aedoeagus, and the form of the pygofer is distinctive.

This species has mainly northern and mountain distribution. British Columbia, Yukon, Alberta, Manitoba, Quebec, and Labrador.

### Genus 35. *Exitianus* Ball

*Exitianus exitiosus* (Uhl.) (Figs. 425, 733, 1179).—Length: 3.5-5.0 mm. Vertex and thorax ochreous-yellowish, the transverse band of the vertex reddish-brown or blackish and the other dark markings black; forewings hyaline or greyish hyaline with the veins distinct and dark brown. The markings and the genitalic characters are distinctive.

A locally common species in grassland areas in southern British Columbia (up to 5,000 feet), Alberta, Manitoba, and southern Ontario. Host plants: grasses.

### Genus 36. *Hardya* Edw.

#### Key to species of *Hardya*

Larger species, 3.0-3.5 mm. long; median transverse band of vertex reaching eyes; spine at apex of male pygofer directed downward; female seventh sternum with numerous longitudinal striae and with postero-lateral corners not broadly emarginate ..... *youngi*

Smaller species, 2.5-3.0 mm. long; median transverse band of vertex usually not reaching eyes; spine at apex of male pygofer directed outward; female seventh sternum without numerous striae, its postero-lateral corners broadly and deeply emarginate ..... *dentata*

*Hardya dentata* (Osb. & Ball) (Figs. 426, 734, 1180).—Length: 2.5-3.0 mm. Vertex and thorax ochreous with the markings dark brown; forewings hyaline brownish with veins ochreous. The colour pattern of the vertex and the genitalic characters are distinctive.

Southern Saskatchewan. The species may live on the ground among litter or grass roots.

*Hardya youngi* Beir. (Figs. 427, 735, 1181).—Length: 3.0-3.5 mm. Vertex and thorax ochreous with the markings dark brown; forewing hyaline brownish with the veins ochreous and usually with fuscous suffusions at the commissure and at the ends of the apical and subapical cells. The colour pattern of the vertex and the form of the pygofer, style, and female seventh sternum are distinctive.

Northern Alaska.

### Genus 37. *Stenometopiellus* Haupt

*Stenometopiellus cookei* (Gill.) (Figs. 428, 1182).—Length: 2.5-3.0 mm. Dull stramineous with the markings brown. The genitalic characters are distinctive.

Southern Alberta.

### Genus 38. *Doratura* Sahlb.

*Doratura stylata* (Boh.) (Figs. 429, 736, 1183).—Length: 3.0-4.0 mm. Dull stramineous with black markings on the vertex and abdomen. Normally brachypterous, but a macropterous form, in which the forewings exceed the abdomen in length in both sexes, occasionally occurs. The flat vertex, with the black spots on its anterior margin, and the genitalic characters are distinctive.

Widely distributed in southern British Columbia and one of the most common and widely distributed leafhoppers on grasslands in southern Ontario and southern Quebec. It occurs among grass roots in meadows and marshes. Host plants: grasses. The species is believed to be an artificial introduction from Europe.

### Genus 39. *Driotura* Osb. & Ball

*Driotura gammaroides* (VanD.) (Figs 430, 737, 1184).—Length: 2.5-3.5 mm. Shining black, except the ovipositor and sometimes the anterior and posterior margins of the vertex, which may be yellowish. A variety that occurs occasionally with the typical form has the body and forewings light reddish-ochreous. The robust build, the black colour of the typical form, and the genitalic characters are distinctive.

Widely distributed and locally common in the grassland regions of Alberta, Saskatchewan, and Manitoba. Host plants: grasses.

### Genus 40. *Athysanella* Bak.

Small insects, usually brachypterous and always exhibiting sexual dimorphism. The known Canadian species are apparently confined to the grassland regions of the Prairie Provinces, but there is reason to believe that a species occurs in British Columbia. Reliable specific characters are in the internal male genitalia and the female seventh sternum. The genus was revised by Ball and Beamer (1940). The host plants are grasses.

**Key to subgenera and species of *Athysanella***

1. Pygofer of male terminating in a hook-like sclerotized process (subgenus *Gladionura* Osb.) ..... 9. *sinuata*
   Pygofer broadly rounded posteriorly ..... 2
2. Hind tibia of male with a large spur at apex (subgenus *Athysanella* Bak.) ..... 3
   Hind tibia of male without spur at apex (subgenus *Amphipyga* Osb.) ..... 5
3. Vertex with two, large, black spots at anterior margin ..... 1. *terebrans*
   Vertex without such spots ..... 4
4. Aedoeagus with a club-like, spined, dorsal process; female seventh sternum very short, with a large, rounded, median expansion ..... 3. *robusta*
   Aedoeagus without dorsal process; female seventh sternum not as above ..... 2. *utahna*
5. Vertex with a pair of large, black spots at anterior margin ..... 6
   Vertex without such spots ..... 6. *attenuata*
6. Aedoeagus with two, dorsal, spined ridges; female seventh sternum with posterior margin feebly excavated at middle ..... 7
   Aedoeagus without dorsal spined ridges; posterior margin of female seventh sternum weakly produced at middle ..... 8
7. Aedoeagus shorter, with dorsal spined ridges from before middle to apex, which is pointed. Mainly in the Prairie Provinces ..... 4. *acuticauda*
   Aedoeagus longer, spined at apical region only. Eastern ..... 5. *longicauda*
8. Aedoeagus strongly recurved; female seventh sternum very short ..... 7. *obesa*
   Aedoeagus not strongly recurved; female seventh sternum not very short ..... 8. *occidentalis*

1. *Athysanella* (*Athysanella*) *terebrans* (Gill. & Bak.) (Figs. 431, 738, 1185).—Length: 3.0-4.5 mm. Dull stramineous with the markings brown. There is variation in the extent of the dark markings, and the black spots on the vertex margin and the dark streaks between the veins of the forewing sometimes are absent. The female seventh sternum is distinctive. The male genitalia resemble those of *utahna* but the lateral arm of the style is relatively much longer in relation to the length of the apical region than in that species.

Widely distributed in the grassland regions, apparently chiefly in hill districts, of Alberta, Saskatchewan, and Manitoba.

2. *Athysanella* (*Athysanella*) *utahna* (Osb.) (Figs. 432, 739, 1186).—Length: 2.0-3.0 mm. Stramineous with the markings brown. Macropterous specimens occur occasionally. There is variation in the extent and intensity of the dark markings and in the form of the posterior margin of the female seventh sternum. However, the genitalic characters are distinctive.

3. *Athysanella* (*Athysanella*) *robusta* (Osb.) (*montana* Osb.) (Figs. 433, 740, 1187).—Length: 3.0-4.0 mm. Stramineous with brownish markings. A macropterous form, in which the forewings exceed the body in length in both sexes, occurs occasionally. The aedoeagus and the female seventh sternum are distinctive.

Widely distributed and locally common in the grassland regions of Alberta, Saskatchewan, and Manitoba.

4. *Athysanella* (*Amphipyga*) *acuticauda* Bak. (Figs. 434, 741, 1188).—Length: 2.5-3.5 mm. Ochreous or whitish, largely suffused with light brownish, with a pair of black spots on the vertex and with the other dark markings of the body brown or fuscous. A macropterous form occurs occasionally. The male genitalia are distinctive.

Widely distributed and locally abundant in the grassland regions of Alberta, Saskatchewan, and Manitoba, and found in southern Quebec.

5. *Athysanella* (*Amphipyga*) *longicauda* Beir. (Figs. 742, 1189).—Length: 2.5-3.5 mm. Colour and markings as in *acuticauda* but with distinct male genitalia.

Widely distributed and locally common in southern Ontario and southern Quebec.

6. *Athysanella* (*Amphipyga*) *attenuata* Bak. (*alta* Osb., *extrusa* Osb.) (Figs. 435, 743, 1190).—Length 3.0-5.0 mm. Stramineous with the markings brownish. The crescent-shaped lines near the anterior margin of the vertex are rather distinctive, except in a common variety in which they form the posterior margins of two, large black spots. The genitalic characters are distinctive.

Northwest Terrtories, and widely distributed in the grassland regions of Alberta and Saskatchewan.

7. *Athysanella* (*Amphipyga*) *obesa* Ball & Beam. (Figs. 436, 744, 1191).—Length: 3.0-4.0 mm. Brownish-stramineous with darker brown markings and with the two large spots of the vertex and the transverse band of the abdomen black. The genitalic characters are distinctive.

Southern Alberta.

8. *Athysanella* (*Amphipyga*) *occidentalis* Bak. (*minuta* Bak.) (Figs. 437, 745, 1192).—Length: 2.0-3.0 mm. Ochreous with the markings dark brown and blackish. There is variation in the shade and intensity of the dark markings. A macropterous form is frequent. A relatively small and strongly-marked species with distinctive genitalic characters.

Widely distributed and locally common in the grassland regions of Alberta and Saskatchewan.

9. *Athysanella* (*Gladionura*) *sinuata* (Osb.) (*abbreviata* Osb.) (Figs. 438, 746, 1193).—Length: 3.0-4.5 mm. Stramineous or pale yellow with the markings dark brown. A relatively pale species, usually with the dark markings absent or only weakly developed. The genitalic characters are distinctive.

Widely distributed in the grassland regions of Alberta, Saskatchewan, and Manitoba.

### Genus 41. *Paramesus* Fieb.

*Paramesus nervosus* (Fall.) (*obtusifrons* Stal) (Figs. 439, 747, 1194).—Length: 5.0-6.5 mm. Light brownish-stramineous or greenish-stramineous with the transverse band of the forewings black and the dark markings of the forewings fuscous or brownish. The markings and the genitalic characters are distinctive.

Southern British Columbia, southern Ontario, and southern Quebec, probably artificially introduced from Europe.

### Genus 42. *Pasaremus* Oman

*Pasaremus concentricus* (Van D.) (*flavomarginatus* Gill. & Bak., *escalentus* Ball) (Figs. 440, 748, 1195).—Length: 3.5-4.5 mm. Ochreous or brownish-ochreous with the band of the vertex black and the veins of the forewing margined with dark brown. There is variation in the dark markings; often there is an irregular, broad, brown or black, posterior transverse band on the vertex, and frequently the vertex is unmarked except for the anterior black band. The markings and the genitalic characters are distinctive.

Widely distributed but local. Southern British Columbia, Northwest Territories, southern Alberta, southern Saskatchewan, and Prince Edward Island. Host plants: probably grasses.

### Genus 43. *Palus* DeL. & Slees. (*Cosmotettix* Rib).

Small, usually well-marked insects that occur in grasslands. There is much variation in colour and markings. The host plants probably are grasses.

#### Key to species of *Palus*

Vertex either without dark markings or marked as follows: a pair of median longitudinal brownish bands each bordered internally by an irregular black line or band and externally near the apex by a shorter black line; pronotum either pale or with broad dark bands ..... *bilineatus*

Vertex with two pairs of large black spots near apex, the pair on each side often confluent, and the pair on each side continuous with a longitudinal brownish band; pronotum with one or two pairs of longitudinal dark bands that are no broader than those of the vertex. ..... *delector*

*Palus bilineatus* (Gill. & Bak.) (*paludosus* Ball, *luteocephalus* Sand. & DeL., *marginatus* DeL., *fasciatus* Beam.) (Figs. 441, 442, 749, 1196).—Length: 3.5-4.0 mm. Pale yellowish, the vertex and pronotum marked as described in the key; forewing whitish or pale yellowish with the cells usually tinged with brown and bordered with dark brown or fuscous internally, especially in the commissural and apical regions. There is extensive variation. The vertex and thorax sometimes lack dark markings; the black lines of the vertex vary in size and the brown bands vary in intensity of colour and are sometimes almost black; the bands of the thorax and scutellum vary from pale yellowish-brown to blackish, and are absent in pale specimens; in very dark specimens the cells of the forewing are largely dark brown whereas in very pale specimens the dark markings of the forewings are reduced to brown spots at the apices of the apical cells; and the black areas of the female seventh sternum vary in size and shape.

Alaska and the southern parts of British Columbia, Alberta, Saskatchewan, Manitoba, and Ontario. Widely distributed but local, in grassland areas.

*Palus delector* (Sand. & DeL.) (*acutus* Beam.) (Figs. 443, 750, 1197).—Length: 3.5-4.0 mm. Light brownish-ochreous with the vertex and pronotum marked as described in the key; forewings pale brownish-ochreous, the cells darkened along the veins, with dark brown or fuscous spots at the apices of the apical cells. Sometimes the dark bands of the vertex and pronotum are very dark brown or black and there is variation in the extent and intensity of the dark markings of the forewings.

Grassland regions of southern British Columbia and southern Saskatchewan.

### Genus 44. *Orocastus* Oman

*Orocastus perpusillus* (Ball & DeL.) (Figs. 444, 751, 1198).—Length: 2.6-3.3 mm. Male bright orange-yellow, female yellowish-stramineous, both sexes without darker markings. The males usually are subbrachypterous but either sex may be macropterous or subbrachypterous. The genitalic characters are distinctive.

Grassland regions of southern British Columbia, southern Alberta, and southern Saskatchewan. Locally abundant in dry situations. Host plants: grasses.

### Genus 45. *Auridius* Oman

Identification of species is on a basis of genitalic characters. The aedoeagus has a membranous connection with a pair of large processes, or paraphyses, that articulate with the apex of the connective. The Canadian species were revised by Beirne (1952). The host plants are grasses.

#### Key to species of *Auridius*

1. Male genitalia with paraphyses more or less straight in lateral and ventral views and each with its apex pointed ..... *flavidus*

2. Apical region of style expanded and flattened, with two digitate processes; posterior margin of female seventh sternum with a pair of pointed processes ..... *ordinatus*
Style not as above; posterior margin of female seventh sternum without processes . *auratus*

*Auridius flavidus* Beir. (Figs. 445, 1199).—Male pale golden yellow without darker markings. The genitalic characters are distinctive.

Southern Alberta.

*Auridius ordinatus* (Ball) (*helvus* DeL.) (Figs. 446, 752, 1200).—Length: 2.7-3.6 mm. Male golden yellow without darker markings; female stramineous, often with two faint longitudinal bands in the vertex and four on the pronotum. Each sex may be macropterous or subbrachypterous. There is some variation in the female seventh sternum, but it and the male genitalia are distinctive.

Widely distributed and locally abundant in hill grasslands in southern British Columbia and in the grassland regions of Alberta and Saskatchewan.

*Auridius auratus* (Gill. & Bak.) (*exectus* DeL., *subrutilus* DeL. & Slees.) (Figs. 447, 753, 1201).—Length: 3.2-3.8 mm. Male golden yellow without darker markings; female stramineous, occasionally with indications of two brownish longitudinal bands on the vertex and four on the pronotum. Each sex may be macropterous or subbrachypterous. The genitalic characters are distinctive.

Widely distributed and locally abundant in hill grasslands in southern British Columbia and the grassland regions of Alberta and Saskatchewan.

### Genus 46. *Mocuellus* Rib.

*Mocuellus collinus* (Boh.) (Figs. 448, 754, 1202).—Length: 3.0-4.0 mm. Yellowish-stramineous, usually with longitudinal brown markings on the abdomen and sometimes with faint indications of two brownish longitudinal bands on the vertex and four on the pronotum. The genitalic characters are distinctive.

Widely distributed and locally abundant in the grassland regions of Alberta, Saskatchewan, and Manitoba.

### Genus 47. *Psammotettix* Haupt (*Ribautiellus* Zakh.)

Small, dull stramineous insects that often are abundant on grasslands. Specific characters are largely in the form of the aedoeagus, though in a few species the female seventh sternum shows specific characters. The host plants are grasses.

#### Key to species of *Psammotettix*

1. Aedoeagus slender, with lateral margins of apical third minutely serrated in posterior view ..... 5. *dentatus*
Aedoeagus slender or stout, if slender then lateral margins not serrated ..... 2
2. Aedoeagus tapered at apex in ventral view, the extreme apex slightly expanded in postero-dorsal view ..... 6. *attenuens*
Aedoeagus not tapered at apex, the apical region rounded and sometimes expanded in postero-dorsal view ..... 3
3. Aedoeagus slender, apical two-thirds almost straight in lateral view, in posterior view with apical region not obviously expanded but with lateral margins obviously thickened beyond edge of gonopore ..... 7. *ferratus*
Aedoeagus either stout and with apical region expanded in posterior view, or slender and with side margins of gonopore not obviously thickened in posterior view ..... 4
4. Apical region of aedoeagus beyond edge of gonopore expanded in posterior view ..... 5
Apical region of aedoeagus beyond edge of gonopore not expanded in dorsal view ..... 8. *lividellus*
5. Aedoeagus short and stout ..... 7
Aedoeagus longer and more slender ..... 6
6. Aedoeagus with apical region hardly expanded in posterior or lateral view 3. *lapponicus*
Aedoeagus with apical region obviously expanded in posterior and lateral views ..... 4. *cephalotes*

7. Aedoeagus with apical region rounded in lateral view, rounded or feebly notched in posterior view ..... 2. *alienus*
Aedoeagus very stout, with apex pointed in lateral view and weakly rounded, almost truncate, in posterior view ..... 1. *confinis*

1. *Psammotettix confinis* (Dahlb.) (?*harrimani* Ashm., *theni* Edw., *spathifer* Rib.) (Figs. 449, 1203).—Length: 3.0-3.5 mm. Dull stramineous with the markings of the vertex and pronotum brownish, and usually with fuscous streaks between the veins of the forewings. The aedoeagus is distinctive.

Alaska.

2. *Psammotettix alienus* (Dahlb.) (*latipex* DeL. & Dav.) (Figs. 450, 755, 1204).—Length: 3.5-4.2 mm. The dark brownish markings of the vertex and pronotum and the fuscous streaks between the veins of the forewings are frequently reduced and sometimes absent, but are well-developed in specimens from northern localities. The aedoeagus is distinctive. The slight median projection of the posterior margin of the female seventh sternum often distinguishes this species from *lividellus*, but this character is not always reliable because of individual variation.

Alaska, British Columbia (up to 5,000 feet), Yukon, Northwest Territories, Alberta, and northern Manitoba.

3. *Psammotettix lapponicus* (Oss.) (?*revae* Knull) (Figs. 451, 1205).—Length: 2.5-2.8 mm. The dark brown markings of the vertex and pronotum and the fuscous markings between the veins of the forewing usually are well developed. The aedoeagus is distinctive.

Alaska, Northwest Territories, and northern Manitoba.

4. *Psammotettix cephalotes* (H.-S.) (*citrinellus* Sahlb., *normani* Scott, *obesus* Knull) (Figs. 452, 1206).—Length: 2.8-3.2 mm. Dull stramineous with the markings brown or fuscous and the veins of the forewing largely whitish. There is variation in the extent and intensity of the dark markings. The aedoeagus is distinctive.

Mountains of British Columbia at 6,200 and 7,600 feet.

5. *Psammotettix dentatus* Knull (Figs. 453, 756, 1207).—Length: 3.0-3.5 mm. The relatively long, pointed vertex with the two pairs of brown or fuscous spots near its anterior margin is rather distinctive. These characters and the seventh sternum are distinctive for the female. The aedoeagus is distinctive.

Southwestern British Columbia.

6. *Psammotettix attenuens* (DeL. & Dav.) (Figs. 454, 757, 1208).—Length: 3.6-4.2 mm. The brownish or fuscous markings of the vertex and pronotum, though not strong, usually are well defined, and the forewings are striated with fuscous between the veins to a greater or lesser extent. The female seventh sternum tends to have the postero-lateral corners more rounded than in other species, but this character is not always reliable because of individual variation. The aedoeagus is distinctive.

Widely distributed in southern British Columbia.

7. *Psammotettix ferratus* (DeL. & Dav.) (Figs. 455, 758, 1209).—Length: 3.5-4.0 mm. The dark markings of the vertex tend to be more or less confluent, giving it a banded appearance. This character is not constant but is often helpful in the preliminary sorting of mixed series of this species and *lividellus*. The aedoeagus is distinctive.

Hill grasslands in southern British Columbia and the grassland regions of Alberta and Saskatchewan.

8. *Psammotettix lividellus* (Zett.) (*affinis* Gill. & Bak.) (Figs. 456, 759, 1210).—Length: 3.0-4.0 mm. There is some local variation in that specimens

from dry southern areas tend to have relatively long forewings and the dark markings reduced or absent whereas specimens from Subarctic localities tend to have relatively short forewings, well-developed dark markings on the vertex and pronotum, and fuscous suffusions between the veins of the forewing. The aedoeagus is distinctive.

This is the most widely distributed of all Canadian leafhoppers and is the only species known to inhabit permanently localities in the Arctic Tundra. It has been found in many localities in Alaska, British Columbia (up to 5,400 feet), Yukon, Northwest Territories (including Richards I. and Baffin I.), Alberta, Saskatchewan, Manitoba, Ontario, Quebec, Labrador, and Greenland.

### Genus 48. *Arthaldeus* Rib.

*Arthaldeus pascuellus* (Fall.) (*punctipes* Zett., *fuscosignatus* Dahlb.) (Figs. 457, 760, 1211).—Length: 3.25-4.0 mm. Pale yellowish with the markings of the vertex brown, but sometimes absent, and the forewings hyaline greenish-yellow. The genitalic characters are distinctive.

Widely distributed in southern Ontario and southern Quebec and found in New Brunswick. It occurs on the ground among the roots of grasses and sedges, which probably are the host plants.

### Genus 49. *Sorhoanus* Rib.

Yellowish-green, rather strongly-coloured insects that often are common in grassy situations in the West and North. The internal male genitalia and the female seventh sternum show reliable specific characters. The host plants probably are grasses or sedges.

#### Key to species of *Sorhoanus*

1. Aedoeagus with a pair of downwardly-directed lateral processes at apex; female seventh sternum with a large median projection that is more or less parallel-sided near its apex and has its apical margin bilobed ..... 1. *flavovirens*
   Aedoeagus without such apical processes; female seventh sternum not as above ..... 2
2. Aedoeagus bilaterally flattened, broad in lateral view, slender in ventral view; connective longer than aedoeagus; female seventh sternum with postero-lateral corners rounded, not produced ..... 3
   Aedoeagus not bilaterally flattened, not or slightly broader in lateral view; connective shorter than aedoeagus; female seventh sternum with postero-lateral corners slightly or distinctly produced ..... 4
3. Aedoeagus with apical region of shaft longer than depth of basal region or than length of dorsal arm, lower margin of expanded portion without minute teeth; female seventh sternum with posterior margin rounded; forewing usually with dark streaks ..... 5. *orientalis*
   Aedoeagus with apical region of shaft shorter than depth of basal region or than length of dorsal arm, lower margin of expanded portion with minute marginal teeth; female seventh sternum tapered posteriorly; forewing without dark markings ..... 4. *ubleri*
4. Shaft of aedoeagus with minute spines, especially on dorsal surface, and apical region not expanded; female seventh sternum with postero-lateral corners not obviously produced and with the median projection black ..... 3. *debilis*
   Shaft of aedoeagus without spines, the apical region expanded in ventral views; female seventh sternum with postero-lateral corners not obviously produced and with the median teeth brown ..... 2. *bidentatus*

1. *Sorhoanus flavovirens* (Gill. & Bak.) (Figs. 459, 761, 1212).—Length: 4.5-5.0 mm. Vertex and thorax greenish-yellow; forewings green or yellowish green. The genitalic characters are distinctive.

This species has a mainly northern and western distribution. It has been found in many localities in Alaska (including a locality on the Tundra), British Columbia (up to 5,400 feet), Yukon, Alberta, Saskatchewan, Quebec, New Brunswick, and Labrador.

2. *Sorhoanus bidentatus* (DeL. & Dav.) (Figs. 458, 762, 1216).—Length: 3.5-4.0 mm. Pale greenish-stramineous without dark markings. The genitalic characters are distinctive.

Southern British Columbia, in mountain districts, and northern Manitoba.

3. *Sorhoanus debilis* (Uhl.) (*cadyi* Deay, *orbiculatus* DeL. & Slees.) (Figs. 460, 763, 1213).—Length: 3.5-4.5 mm. Yellowish-green without dark markings. The genitalic characters are distinctive.

A local species found in grassland areas in southern British Columbia.

4. *Sorhoanus uhleri* (Oman) (Figs. 461, 764, 1214).—Length: 3.5-5.0 mm. Yellowish-green without darker markings. The genitalic characters are distinctive.

Widely distributed in grassland areas in British Columbia, Yukon, Alberta, Saskatchewan, and Manitoba.

5. *Sorhoanus orientalis* (DeL. & Dav.) (Figs. 462, 765, 1215).—Length: 3.0-4.0 mm. Vertex and pronotum yellowish-green; forewings ochreous-greenish, usually with a broad, longitudinal, fuscous stripe occupying most of the clavus, a second such stripe on the corium, and the apical cells fuscous. Occasionally these dark markings are enlarged and confluent and they are frequently reduced or absent. The dark markings, when present, and the genitalic characters are distinctive.

Widely distributed in the grassland regions, particularly in hill districts, of Alberta, Saskatchewan, and Manitoba, and found also in southern Ontario, northern Quebec, and Labrador.

### Genus 50. *Cazenus* Oman

*Cazenus xanthoneurus* (Fieb.) (*canadensis* DeL., *cicatrix* DeL. & Slees.) (Figs. 463, 766, 1217).—Length: 3.0-3.5 mm. Greenish-ochreous, sometimes with a pair of brownish arcs near the anterior margin of the vertex and with the forewings bordered with brown. The genitalic characters are distinctive.

Alaska, British Columbia in mountain districts, Yukon, Northwest Territories, Alberta in mountain districts, northern Manitoba, and northern Quebec.

### Genus 51. *Laevicephalus* DeL.

Small, pale yellowish or pale greenish insects without distinct dark markings. They are found among grass roots. It is likely that species additional to those discussed below occur in Canada. Identification is on characters of the male and female genitalia. The host plants probably are grasses.

#### Key to species of *Laevicephalus*

1. Aedoeagus stout, forked at apex, with dorsal process almost as long as shaft ..... *poudris*
   Aedoeagus slender, pointed or bluntly rounded at apex, with dorsal process less than one-quarter length of shaft ..... 2
2. Aedoeagus pointed at apex in ventral view; male pygofer with rounded projection on ventral margin; posterior margin of female seventh sternum with a median projection ..... *sylvestris*
   Aedoeagus rounded at apex in ventral view; male pygofer with spined projection at postero-ventral corner; posterior margin of female seventh sternum broadly but shallowly emarginate at middle ..... *melsheimerii*

*Laevicephalus poudris* Tuth. (Figs. 464, 767, 1218).—Length: 3.5 mm. Dull greenish-stramineous without definite dark markings. The aedoeagus and the female seventh sternum are distinctive.

Southern Alberta and southern Saskatchewan.

*Laevicephalus sylvestris* (Osb. & Ball) (*acus* Sand. & DeL., *rotundens* DeL. & Dav.) (Figs. 465, 768, 1219).—Length: 3.25-3.5 mm. Stramineous or yellowish-green, the forewings with the veins paler. The genitalic characters are distinctive.

Widely distributed in grassland regions of Alberta, Saskatchewan, and Manitoba, southern Ontario, southern Quebec, and Nova Scotia.

*Laevicephalus melsheimerii* (Fitch) (*vicillinus* Crumb.) (Figs. 466, 769, 1220).—Length: 2.5-3.0 mm. Stramineous or yellowish without definite dark markings. The genitalic characters are distinctive.

Widely distributed in southern Ontario and southern Quebec.

### Genus 52. *Lemellus* Oman

*Lemellus bimaculatus* (Gill & Bak.) (Figs. 467, 770, 1221).—Length: 3.5-4.0 mm. Ochreous or whitish-ochreous, usually tinged with greenish, with the spots of the vertex black. These spots and the genitalic characters are distinctive.

Locally but widely distributed in grasslands in Alaska, British Columbia, Yukon, Northwest Territories, Alberta, Saskatchewan, and Manitoba. Host plants: probably grasses.

### Genus 53. *Verdanus* Oman

*Verdanus evansi* (Ashm.) (Figs. 468, 771, 1222).—Length: 3.5-4.5 mm. Green without darker markings. It superficially resembles species of *Sorhoanus*. The genitalic characters are distinctive. There is local variation in the size of the spine of the pygofer, which is occasionally absent.

This species has a mainly mountain and Boreal distribution and is one of the dominant species of the Subarctic. Alaska, British Columbia (up to 4,500 feet), Yukon, Northwest Territories, mainly in hill and mountain districts in Alberta and Saskatchewan, northern and southern Manitoba, southern Ontario, northern and southern Quebec, and Labrador. Host plants: grasses and sedges.

### Genus 54. *Diplocolenus* Rib.

*Diplocolenus configuratus* (Uhl.) (Figs. 469, 772, 1223).—Length: 3.0-4.0 mm. Stramineous or ochreous with the markings of the vertex and thorax brown and those of the forewings dark brown. There is extensive individual variation: some specimens are virtually unmarked, whereas others have the vertex and thorax heavily marked with dark brown and the veins of the forewing strongly margined with dark brown; most specimens are intermediate between these extremes. The genitalic characters are distinctive.

This is one of the most common species of leafhoppers on grasslands. Its distribution covers the greater parts of the southern and Boreal regions. British Columbia, Northwest Territories, Alberta, Saskatchewan, Manitoba, Ontario, Quebec, and Labrador. Host plants: *Sabinia horizontalis* and other grasses.

### Genus 55. *Flexamia* DeL.

Members of this genus inhabit grasslands and, in Canada are largely confined to the Prairie Provinces. Specific characters are largely in the internal male genitalia, though the female seventh sternum often shows reliable specific characters. At time of writing the North American species are under revision by D. A. Young and B. P. Beirne.

#### Key to species of *Flexamia*

1. Aedoeagus without processes at apical region, with the apex hooked dorsally in lateral view; small species, 2.5-3.0 mm. long ..... 2. *abbreviata*
   Aedoeagus with processes at apical region; larger species, 3.0 mm. or more in length ..... 2
2. Aedoeagus with more than three processes at apical region ..... 3
   Aedoeagus with five processes at apical region ..... 7. *serrata*
3. Aedoeagus asymmetrical, with two processes at apex ..... 4
   Aedoeagus symmetrical, with three processes at apex ..... 5
4. Gonopore near apex of aedoeagus, with its anterior edge not produced as a lobe; large species, 4.0-5.0 mm. long; ochreous with brown stripes ..... 1. *grammica*

Gonopore on shaft of aedoeagus, with its anterior edge produced as a large lobe; smaller species, 3.5-4.0 mm. long; not striped ..... 3. *visenda*

5. Dorsal pair of aedoeagal processes with serrated edges ..... 4. *decora*
Edges of aedoeagal processes not serrated ..... 6

6. Aedoeagal processes long, almost half as long as shaft; posterior margin of pygofer produced as a long spine ..... 5. *stylata*
Aedoeagal processes under one-quarter length of shaft; posterior margin of pygofer not produced as a spine ..... 6. *flexulosa*

1. *Flexamia grammica* (Ball) (Figs. 470, 773, 1224).—Length: 4.0-5.0 mm. Ochreous with the markings of the vertex, thorax, and costal region of the forewing dark brown and the remaining dark markings of the forewing brown or dark brown. The colour and markings and the genitalic characters are distinctive.

Apparently local but widely distributed in the grassland region of Saskatchewan.

2. *Flexamia abbreviata* (Crumb.) (Figs. 472, 776, 1226).—Length: 2.5-3.0 mm. Stramineous with the markings dark brown. The aedoeagus is distinctive.

Grassland regions of Alberta and Saskatchewan.

3. *Flexamia visenda* (Crumb.) (Figs. 471, 1225).—Length: 3.5-4.0 mm. Ochreous with the markings brown. The genitalic characters are distinctive. Related, non-Canadian, species that have a similar type of aedoeagus have a projecting lip on the proximal edge of the gonopore.

Southern Manitoba.

4. *Flexamia decora* Beam. & Tuth. (Figs. 476, 1230).—Length: 3.5-4.0 mm. Vertex and thorax ochreous with the markings brown; forewings greyish-ochreous with the markings brown. The genitalic characters are distinctive.

Southern Saskatchewan.

5. *Flexamia stylata* (Ball) (Figs. 474, 1228).—Length: 3.5-4.0 mm. Stramineous with lines bordering the anterior margin of the vertex reddish and the other dark markings dark brown. The genitalic characters are distinctive.

Southern Saskatchewan.

6. *Flexamia flexulosa* (Ball) (Figs. 473, 775, 1227).—Length: 3.0-3.5 mm. Stramineous with the markings brown. There is some variation in the size and intensity of the dark markings, particularly those of the forewings. The genitalic characters are distinctive.

Widely distributed in the grassland regions of Alberta and Saskatchewan.

7. *Flexamia serrata* Beam. & Tuth. (Figs. 475, 774, 1229).—Length: 4.0 mm. Pale ochreous with the markings brown. The absence of markings on the vertex, except for the pair at the apex, is rather distinctive. The genitalic characters are distinctive.

Grassland regions of southern British Columbia and Saskatchewan.

### Genus 56. *Latalus* DeL. & Slees. (*Quontus* Oman)

Specific characters are primarily in the form of the aedoeagus, though in some species the female seventh sternum shows characters of value. The Canadian species were revised by Beirne (1954). The host plants are probably grasses.

#### Key to species of *Latalus*

1. Aedoeagus with one or more pairs of spine-like process at or near apex ..... 2
Aedoeagus without processes ..... 1. *missellus*

2. Aedoeagus stout or slender, strongly curved upward in lateral view ..... 3
Aedoeagus stout, curved downward in lateral view ..... 6. *sayi*

3. Aedoeagus with a single pair of processes ..... 4
Aedoeagus with two or three pairs of processes ..... 5

4. Aedoeagus flattened, with shaft broad in ventral view and slender in lateral view 3. *hultus*
Aedoeagus not flattened, with shaft no broader in ventral than in lateral view 2. *curtus*
5. Aedoeagus with three pairs of processes 5. *personatus*
Aedoeagus with two pairs of processes 4. *histrionicus*

1. *Latalus missellus* (Ball) (*occidentalis* DeL., *mundus* Beam. & Tuth.) (Figs. 477, 777, 1231).—Length: 2.0-2.5 mm. Vertex and thorax ochreous or stramineous with the markings brown or dark brown; forewings ochreous or greyish-ochreous with the markings dark brown. There is some variation in the extent and intensity of the dark markings. The genitalic characters are distinctive.

Alaska, British Columbia (up to 4,000 feet), Yukon, and mountains of Alberta.

2. *Latalus curtus* Beam. & Tuth. (Figs. 478, 778, 1232).—Length: 2.0-2.5 mm. Vertex and thorax stramineous or pale ochreous with the markings brown; forewings ochreous or greyish-ochreous with the markings dark brown. There is some variation in the size and intensity of the dark markings. The genitalic characters are distinctive.

Widely distributed in southern British Columbia.

3. *Latalus hultus* Beir. (Figs. 479, 1233).—Length 3.2 mm. Stramineous, the forewings with weak brown markings and with the veins broadly yellow. The genitalic characters are distinctive.

Southern Manitoba.

4. *Latalus histrionicus* Beir. (Figs. 480, 779, 1234).—Length: 3.0-3.5 mm. Stramineous with ochreous or brown markings and with the crossveins of the forewing whitish. The aedoeagus is distinctive.

Southern British Columbia, widely distributed and locally common, and Northwest Territories.

5. *Latalus personatus* Beir.(Figs. 481, 780, 1235).—Length: 2.8-3.2 mm. Greyish-stramineous with the markings ochreous or brownish and the forewings with the veins broadly yellow. There is variation in the size and intensity of the dark markings. The aedoeagus is distinctive.

Widely distributed and locally abundant in the southern parts of Alberta, Saskatchewan, Manitoba, Ontario, and Quebec.

6. *Latalus sayi* (Fitch) (Figs. 482, 781, 1236).—Length: 2.5-3.0 mm. Vertex and thorax ochreous with the markings brownish; forewings ochreous-grey with the markings fuscous and with the veins in the region of the bases of the anteapical cells usually white. There is much variation in the extent and intensity of the dark markings. This species tends to be marked more strongly than its allies, and has a distinctly banded appearance. The genitalic characters are distinctive.

Widely distributed and locally abundant in southern Ontario and southern Quebec and found in New Brunswick.

### Genus 57. *Errastunus* Fall.

*Errastunus ocellaris* (Fall.) (*sobrinus* DeL. & Dav.) (Figs. 483, 782, 1237).—Length 3.0-4.0 mm. Vertex and thorax ochreous with the markings brownish; forewings with the cells tawny and margined with fuscous, sometimes largely fuscous, and with the veins broadly whitish. There is much variation in the extent of the dark markings. The genitalic characters are distinctive.

This species has a mainly northern and mountain distribution. Alaska, British Columbia (up to 4,500 feet), Yukon, Northwest Territories, grassland regions of Saskatchewan and Manitoba, northern Manitoba, southern and northern Quebec, and Labrador. Host plants: grasses or sedges.

### Genus 58. *Pinumius* Rib.

*Pinumius areatus* (Stal) (*sexmaculatus* Gill. & Bak.) (Figs. 484, 783, 1238).—Length: 2.5-3.0 mm. Vertex and thorax ochreous with the markings black; forewings greyish-ochreous with the markings fuscous. There is much variation in the extent of the dark markings of the forewings. The colour pattern of the vertex and the genitalic characters are distinctive.

Widely distributed on mountain grasslands in southern British Columbia and found locally in the grassland regions of Alberta and Saskatchewan. Host plants: probably grasses.

### Genus 59. *Rosenus* Oman

#### Key to species of *Rosenus*

Male pygofer with a posteriorly-directed, spine-like process at apex; aedoeagus almost straight in lateral view, with apical region expanded in ventral view ..... *cruciatus*

Male pygofer with an inwardly-directed spine-like process at apex that is visible in posterior or ventral views; aedoeagus sinuate in lateral view with apical region not expanded in ventral view ..... *obliquus*

*Rosenus cruciatus* (Osb. & Ball.) (?*acutus* Beam.) (Figs. 485, 784, 1239).—Length: 2.5-3.0 mm. Vertex and thorax ochreous with the markings brown; forewings greyish-ochreous with the marking fuscous. There is some variation in the extent of the dark markings, the relative length of the forewing, the form of the aedoeagus, and the form of the female seventh sternum. This variation covers the specific differences between *cruciatus* and *acutus*. The genitalic characters are distinctive.

Widely distributed and locally common in Alaska, British Columbia (up to 3,200 feet), Yukon, Northwest Territories, and grassland regions of Alberta and Saskatchewan.

*Rosenus obliquus* (DeL. & Dav.) (Figs. 486, 1240).—Length: 2.5-3.0 mm. Vertex and thorax ochreous with the markings dark brown; forewings greyish-ochreous with the markings fuscous. The genitalic characters are distinctive.

Over 5,000 feet on mountains in southern British Columbia.

### Genus 60. *Hebecephalus* DeL.

The internal male genitalia must be examined for reliable specific identifications. The host plants probably are grasses. The genus was revised by Beamer and Tuthill (1935).

#### Key to species of *Hebecephalus*

1. Aedoeagus with two pairs of processes at apex ..... 1. *algidus*
   Aedoeagus with a single pair of processes at apex, or without apical processes ..... 2
2. Aedoeagus with a single pair of processes at or before middle of shaft ..... 2. *creimus*
   Aedoeagus with a pair of processes at apex of shaft ..... 3
3. Apical processes of aedoeagus very short, each broad at base and rapidly tapering, shaft of aedoeagus with a pair of short, pointed projections immediately below apical processes ..... 3. *crassus*
   Apical processes longer, digitate ..... 4
4. Aedoeagus pointed at apex ..... 4. *truncatus*
   Aedoeagus rounded at apex ..... 5
5. Shaft of aedoeagus with a pair of short, pointed projections at middle ..... 5. *mornus*
   Shaft of aedoeagus without pointed projections ..... 6
6. Apical processes of aedoeagus directed downward and shaft in ventral view expanded at middle ..... 6. *occidentalis*
   Apical processes of aedoeagus directed laterally and shaft not or hardly expanded at middle in ventral view ..... 7
7. Apical region of style very stout, not curved ..... 8. *pedecurtus*
   Apical region of style not very stout, strongly curved ..... 7. *rostratus*

1. *Hebecephalus algidus* DeL. & Dav. (Figs. 487, 785, 1241).—Length: 3.5 mm. Vertex and thorax ochreous with the markings brown or fuscous; forewings whitish-ochreous with the markings fuscous and the veins largely white. There is much variation in the extent and intensity of the dark markings, which are much reduced in some specimens. A strongly-marked species with distinctive male genitalia.

This species has a Subarctic and mountain distribution. Alaska, Northwest Territories, mountain districts of Alberta, northern Alberta, and northern Quebec.

2. *Hebecephalus creimus* Beir. (Figs. 488, 789, 1243).—Length: 3.5-4.0 mm. Vertex and thorax ochreous with the markings brown or fuscous; forewings whitish-ochreous with the markings fuscous. The genitalic characters are distinctive.

Southern British Columbia (at 5-6,000 feet), Northwest Territories, and mountains of Alberta.

3. *Hebecephalus crassus* (DeL.) (Figs. 489, 787, 1244).—Length: 2.75-3.0 mm. Vertex and thorax ochreous with the markings brown or fuscous; forewings greyish-ochreous with the markings fuscous. The genitalic characters are distinctive.

Southern British Columbia.

4. *Hebecephalus truncatus* Beam. & Tuth. (Figs. 490, 788, 1245).—Length: 2.75-3.5 mm. Vertex and thorax ochreous with the markings brown or fuscous; forewings whitish-ochreous with the markings fuscous. The genitalic characters are distinctive.

Widely distributed and locally common in the grassland regions of Alberta and Saskatchewan.

5. *Hebecephalus mornus* Beir. (Figs. 491, 786, 1242).—Length: 3.0 mm. Vertex and thorax ochreous with the markings brown or fuscous; forewings whitish-ochreous with the markings fuscous. There is some variation in the extent of the dark markings. The aedoeagus is distinctive.

Southern British Columbia.

6. *Hebecephalus occidentalis* Beam. & Tuth. (Figs. 492, 790, 1246).—Length: 3.0-3.5 mm. Vertex and thorax ochreous with the markings brown or fuscous; forewings whitish-ochreous with the markings fuscous. There is some variation in the extent of the dark markings. The aedoeagus is distinctive.

Southern Saskatchewan.

7. *Hebecephalus rostratus* Beam. & Tuth. (Figs. 493, 791, 1247).—Length: 3.0-3.5 mm. Vertex and thorax ochreous with the markings brown; forewings whitish with the markings fuscous. The aedoeagus is distinctive.

Widely distributed and locally common in the grassland regions of Alberta and Saskatchewan.

8. *Hebecephalus pedecurtus* Whit. & Beam. (Figs. 494, 1248).—Length: 2.75-3.0 mm. Vertex and thorax ochreous with the markings brown; forewings whitish-ochreous with the markings fuscous. The genitalic characters, notably the form of the style, are distinctive.

Southern Manitoba.

### Genus 61. *Commellus* Gill. & Bak.

Rather large insects, as compared with species of related genera. The apical region of the aedoeagus is enclosed in a large, hood-like development of the tenth segment. Specific characters are in the colour and markings and in the genitalia. The host plants are grasses.

**Key to species of *Commellus***

Forewing with longitudinal dark stripes ..... *comma*
Forewing not as above, with veins dark-margined ..... *sexvittatus*

*Commellus sexvittatus* (Van D.) (Figs. 495, 792, 1249).—Length: 3.0-3.5 mm. Stramineous with the spots at the apex of the vertex black and the other dark markings of the head and thorax brown; forewings usually with the veins more or less margined with brownish. The markings and the genitalic characters are distinctive.

Grassland areas of southern British Columbia and the grassland regions of Alberta and Saskatchewan.

*Commellus comma* (Van D.) (Figs. 496, 793, 1250).—Length: 3.5-5.0 mm. Pale ochreous with the band on the clavus, the band parallel to the costa, and the band in the apical cells of the forewing reddish-brown and the remaining dark markings of the vertex, thorax, and forewings blackish. The markings and the genitalic characters are distinctive.

Southern Saskatchewan and southern Ontario.

**Genus 62. *Cabrulus* Oman**

*Cabrulus labeculus* (DeL.) (Figs. 497, 794, 1251).—Length: 2.5-3.0 mm. Vertex and thorax pale stramineous with the markings brown; forewings stramineous-whitish with the markings fuscous. There is individual variation in wing length: the wings may be shorter or longer than the abdomen. The markings and the genitalic characters are distinctive.

Widely distributed and locally common in the grassland regions of Alberta and Saskatchewan. Host plants: probably grasses.

**Genus 63. *Deltocephalus* Burm.**

Specific characters are in the markings, the male genitalia, and the female seventh sternum. It is possible that species additional to those discussed below inhabit Canada. The host plants probably are grasses.

**Key to species of *Deltocephalus***

1. Vertex with a pair of large, round, black spots and with other dark markings reduced or absent; aedoeagus with a pair of lateral processes ..... 2
   Vertex not marked as above; aedoeagus without lateral processes ..... 3
2. Forewings usually without distinct markings; lateral processes of aedoeagus long ..... 6. *valens*
   Forewings with the veins dark-margined; lateral processes of aedoeagus short ..... 7. *grex*
3. Extreme apex of aedoeagus curved posteriorly ..... 4
   Extreme apex of aedoeagus not curved posteriorly, usually curved anteriorly ..... 5
4. Aedoeagus curved upward beyond middle; forewings largely or almost wholly fuscous ..... 1. *fuscinervosus*
   Aedoeagus curved upward at middle; forewing largely pale with fuscous patches ..... 4. *nigriventer*
5. Forewing with definite light and dark areas forming irregular transverse bands ..... 6
   Forewing without definite light and dark areas, brownish-ochreous with the veins paler ..... 5. *balli*
6. Dark markings of forewings fuscous; apex of aedoeagus rounded in lateral view ..... 2. *castoreus*
   Dark markings of forewings brown; apex of aedoeagus hooked anteriorly in lateral view ..... 3. *pulicaris*

1. *Deltocephalus fuscinervosus* Van D. (Figs. 498, 795, 1252).—Length: 3.0 mm. Vertex ochreous with the markings black; pronotum and scutellum black, usually with a few small, ochreous spots; forewing fuscous, paler toward apex and sometimes with the veins distinctly paler. The dark colour and the genitalic characters are distinctive.

Widely distributed in southern British Columbia.

2. *Deltocephalus castoreus* Ball (*giffardi* Van D.) (Figs. 499, 796, 1253).—Length: 2.5-3.0 mm. Vertex and thorax light ochreous with the markings black; forewing whitish with the markings fuscous. There is variation in the extent of the dark markings. The banded forewings are rather distinctive, and the genitalia show good specific characters.

Widely distributed in southern British Columbia.

3. *Deltocephalus pulicaris* (Fall.) (Figs. 500, 797, 1254).—Length: 2.5-3.0 mm. Vertex and thorax ochreous with the markings brown or fuscous; forewings whitish-ochreous with the markings brown. There is variation in the extent of the dark markings. The genitalic characters are distinctive.

Northern Manitoba, southern and northern Quebec, and New Brunswick.

4. *Deltocephalus nigriventer* Sand. & DeL. (Figs. 501, 798, 1255).—Length: 3.0 mm. Vertex ochreous with the markings black and brown; thorax ochreous-brownish with the markings brown; forewings greyish-ochreous with the markings fuscous and brown. The genitalic characters are distinctive.

Alaska, mountains of British Columbia, Northwest Territories, and northern Quebec.

5. *Deltocephalus balli* Van D. (Figs. 502, 799, 1256).—Length: 3.0-3.5 mm. Vertex and thorax ochreous with the markings black and brown; forewings brownish-ochreous with the veins paler. The genitalic characters are distinctive.

Widely distributed in the southern parts of Alberta, Saskatchewan, Ontario, and Quebec.

6. *Deltocephalus valens* Beam. & Tuth. (Figs. 503, 1257).—Length: 3.0 mm. Vertex ochreous with the spots black; thorax ochreous, tinged brownish; forewings brownish-ochreous without distinct dark markings. The genitalic characters are distinctive.

Grassland regions of Alberta and Saskatchewan.

7. *Deltocephalus grex* Oman (Figs. 504, 800, 1258).—Length 3.5 mm. Vertex ochreous with the spots black; thorax brownish-ochreous; forewings ochreous, tinged with brownish or fuscous bordering the veins. The genitalic characters are distinctive.

Widely distributed in southern British Columbia.

### Genus 64. *Unoka* Laws.

*Unoka gillettei* Metc. (*ornata* Gill) (Figs. 505, 801, 1259).—Length: 2.0-2.5 mm. Vertex dark brown; pronotum dark brown anteriorly, otherwise ochreous-whitish; scutellum dark brown and whitish; forewing whitish with the transverse bands dark blackish-brown. There is variation in the extent of the dark markings. The general form of this species, the markings, and the genitalic characters are distinctive.

Southern British Columbia, on hill grasslands. Host plants: probably grasses.

### Genus 65. *Polyamia* DeL.

*Polyamia apicata* (Osb.) (Figs. 506, 1260).—Length: 2.5-3.0 mm. Ochreous with the markings of the vertex black and brown and those of the scutellum brown; forewings whitish-ochreous with the markings brownish-fuscous. The markings and the genitalic characters are distinctive.

Southern Ontario, southern Quebec, and New Brunswick. Host plants: probably grasses.

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### Genus 66. *Endria* Oman

#### Key to species of *Endria*

Forewing much shorter than abdomen; pronotum and scutellum not with distinct black spots ..... *rotunda*
Forewing as long or longer than abdomen; pronotum and scutellum each with a pair of large black spots ..... *inimica*

*Endria inimica* (Say) (*sexpunctata* Prov., *montana* DeL. & Slees.) (Figs. 507, 802, 1261).—Length: 4.0-5.0 mm. Pale brownish-ochreous with the paired spots of the vertex, pronotum, and scutellum black and the other dark markings of the body and forewings brown or fuscous. There is variation in the size and intensity of the dark markings. A short-winged form occurs in the Cypress Hills, Alberta. The markings and the genitalic characters are distinctive.

Widely distributed and common in grasslands in the southern parts of British Columbia, Alberta, Saskatchewan, Manitoba, Ontario, and Quebec. Heavy infestations sometimes develop on lawns in southern Ontario.

*Endria rotunda* (Beam.) (Figs. 508, 803, 1262).—Length: 3.5-4.5 mm. Pale brownish-ochreous or stramineous with the markings brown and dark brown. There is variation in the size and intensity of the dark markings. The general form, the markings, and the genitalic characters are distinctive.

Southern British Columbia and southern Manitoba, in grasslands.

### Genus 67. *Lonatura* Osb. & Ball

Moderate-sized, short-winged insects. Specific characters are largely in the genitalia. The host plants probably are grasses.

#### Key to species of *Lonatura*

1. Basal region of aedoeagus in lateral view much stouter than apical region; vertex with well-defined black markings ..... 1. *megalopa*
   Basal region of aedoeagus in lateral view not much stouter than apical region; dark markings of vertex ill-defined or absent ..... 2
2. Aedoeagus stout, almost straight in lateral view ..... 4. *melina*
   Aedoeagus stout or slender, curved upward in lateral view ..... 3
3. Aedoeagus short and stout; vertex and abdomen with some dark markings ..... 3. *salsura*
   Aedoeagus longer and more slender; vertex and abdomen without dark markings ..... 2. *crocea*

1. *Lonatura megalopa* Osb. & Ball. (Figs. 509, 804, 1263).—Length: 3.0-3.25 mm. Vertex ochreous with the markings black; pronotum, scutellum, and forewings brownish-stramineous; abdomen black with the posterior margins of the segments broadly yellowish. The genitalic characters are distinctive.

Southern Saskatchewan.

2. *Lonatura crocea* Beir. (Figs. 512, 805, 1264).—Length: 4.0-4.5 mm. Yellowish-ochreous without dark markings; forewings hyaline yellowish-ochreous. The colour and the genitalic characters are distinctive.

Grassland regions of Saskatchewan and Manitoba.

3. *Lonatura salsura* Ball (*turbinea* DeL. & Dav.) (Figs. 510, 806, 1265).—Length: 3.4-4.0 mm. Brownish-stramineous, sometimes with indistinct darker markings on the vertex and pronotum and usually with fuscous markings near the sides of the abdomen. The genitalic characters are distinctive.

Southern British Columbia, southern Alberta, and southern Saskatchewan, on grasslands.

4. *Lonatura melina* DeL. (Figs. 511, 807, 1266).—Length: 4.0-5.0 mm. Stramineous with the markings brownish. The dark markings are virtually absent in some specimens. The genitalic characters are distinctive.

Southern Saskatchewan.

### Genus 68. *Amblysellus* Slees.

*Amblysellus curtisii* (Fitch) (*nervatus* Prov.) (Figs. 513, 808, 1267).—Length: 3.0-3.5 mm. Vertex and scutellum yellow with the markings black; pronotum greenish-yellow and black; forewings pale greenish-yellow with the markings fuscous. The colour and markings are distinctive.

Widely distributed in southern Ontario and southern Quebec and found in New Brunswick. Host plants: probably grasses.

### Genus 69. *Graminella* DeL. (*Unerus* DeL.)

The genus was revised by DeLong and Mohr (1937).

#### Key to species of *Graminella*

Aedoeagus shorter, with apex sharply recurved; face heavily marked with black ..... *nigrifrons*
Aeodoeagus longer, with apex not recurved; face usually only weakly dark-marked ..... *fitchii*

*Graminella nigrifrons* (Forbes) (*perpunctata* Van D., ?*pallidula* Osb.) (Figs. 514, 515, 809, 1268).—Length: 3.0-3.5 mm. Pale greenish-yellow with the spots of the vertex black; forewings weakly tinged with fuscous between the veins, which are pale yellowish. The genitalic characters are distinctive. It is possible that *G. pallidula* (Fig. 515) may be a pale form of this species.

Southern Alberta and southern Ontario. Host plants: probably grasses.

*Graminella fitchii* (Van D.) (*quadripunctata* Van D.) (Figs. 516, 810, 1269).—Length: 4.0 mm. Ochreous with the spots of the vertex black and the pronotum with light brown bands; forewings light brown between the veins. The genitalic characters are distinctive.

Southern Ontario, especially in moist situations. Host plants: probably grasses.

### Genus 70. *Amplicephalus* DeL.

#### Key to species of *Amplicephalus*

Vertex with a pair of large, ovoid, black spots ..... *simplex*
Vertex without such spots ..... *osborni*

*Amplicephalus simplex* (Van D.) (*simplarius* Osb. & Ball) (Figs. 517, 811, 1270).—Length 5.0-5.5 mm. Greenish-yellow with the markings of the vertex fuscous; forewings hyaline greenish-yellow with the veins yellowish. The markings of the vertex and the genitalic characters are distinctive.

Nova Scotia.

*Amplicephalus osborni* (Van D.) (Figs. 518, 812, 1271).—Length: 4.5-5.0 mm. Ochreous with the spots at the apex of the vertex black and the other dark markings brown. The genitalic characters are distinctive.

Southern Ontario.

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Figs. 1015-1028. Male genital structures of Typhlocybinae: *Empoasca* spp.

Figs. 1029-1044. Male genital structures of Deltocephalinae: 1029-1038, *Scaphytopius* (*Cloanthanus*) spp.; 1039, *Acinopterus* sp.; 1040, *Nesosteles* sp.; 1041-1043, *Balclutha* spp.; 1044, *Macrosteles* (*Davisonia*) sp.

Figs. 1045-1072. Male genital structures of Deltocephalinae: 1045, 1046, *Macrosteles* (*Davisonia*) spp.; 1047, 1048, *Macrosteles* (*Sonronius*) spp.; 1049-1062, *Macrosteles* (*Macrosteles*) spp.; 1063, *Prescottia* sp.; 1064-1072, *Scaphoideus* spp.

Figs. 1073-1091. Male genital structures of Deltocephalinae: 1073-1075, *Scaphoideus* spp.; 1076-1079, *Osbornellus* spp.; 1080, *Allygus* sp.; 1081-1086, *Chlorotettix* spp.; 1087-1091, *Colladonus* spp.

Figs. 1092-1111. Male genital structures of Deltocephalinae: 1092-1096, *Colladonus* spp.; 1097-1099, *Idiodonus* spp.; 1100, *Ballana* sp.; 1101, 1102, *Mesamia* spp.; 1103-1104, *Twiningia* spp.; 1105, *Fitchana* sp.; 1106, 1107, *Bandara* spp.; 1108-1111, *Norvellina* spp.

Figs. 1112-1132. Male genital structures of Deltocephalinae: 1112-1127, *Paraphlepsius* spp.; 1128-1132, *Texananus* spp.

Figs. 1133-1150. Male genital structures of Deltocephalinae: 1133, *Opsius* sp.; 1134, *Fieberiella* sp.; 1135-1142, *Cicadula* spp.; 1143, *Calanana* sp.; 1144, *Paluda* sp.; 1145-1147, *Elymana* spp.; 1148, *Euscelis* sp.; 1149, *Macustus* sp.; 1150, *Thamnotettix* sp.

Figs. 1151-1170. Male genital structures of Deltocephalinae: 1151, *Doliotettix* sp.; 1152, *Euscelidius* sp.; 1153-1156, *Streptanus* spp.; 1157, 1158, *Coulinus* spp.; 1159, *Frigartus* sp.; 1160, *Extrusanus* sp.; 1161, *Athysanus* sp.; 1162-1166, *Limotettix* spp.; 1167-1170, *Scleroracus* spp.

Figs. 1171-1192. Male genital structures of Deltocephalinae: 1171-1178, *Scleroracus* spp.; 1179, *Exitianus* sp.; 1180, 1181, *Hardya* spp.; 1182, *Stenometopiellus* sp.; 1183, *Doratura* sp.; 1184, *Driotura* sp.; 1185-1192, *Athysanella* spp.

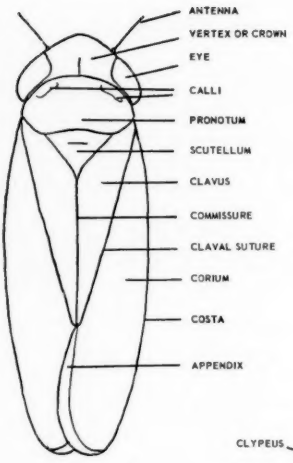
Figs. 1193-1213. Male genital structures of Deltocephalinae: 1193, *Athysanella* sp.; 1194, *Paramesus* sp.; 1195, *Pasaremus* sp.; 1196, 1197, *Palus* spp.; 1198, *Orocastus* sp.; 1199-1201, *Auridius* spp.; 1202, *Mocuellus* sp.; 1203-1210, *Psammotettix* spp.; 1211, *Arthaldeus* sp.; 1212, 1213, *Sorhoanus* spp.

Figs. 1214-1230. Male genital structures of Deltocephalinae: 1214-1216, *Sorhoanus* spp.; 1217, *Cazenus* sp.; 1218-1220, *Laevicephalus* spp.; 1221, *Lemellus* sp.; 1222, *Verdanus* sp.; 1223, *Diplocolenus* sp.; 1224-1230, *Flexamia* spp.

Figs. 1231-1248. Male genital structures of Deltocephalinae; 1231-1236, *Latalus* spp.; 1237, *Errastunus* sp.; 1238, *Pimunius* sp.; 1239, 1240, *Rosenus* spp.; 1241-1248, *Hebecephalus* spp.

Figs. 1249-1262. Male genital structures of Deltocephalinae: 1249, 1250, *Commellus* spp.; 1251, *Cabrulus* sp.; 1252-1258, *Deltocephalus* spp.; 1259, *Unoka* sp.; 1260, *Polyamia* sp.; 1261, 1262, *Endria* spp.

Figs. 1263-1277. Deltocephalinae. 1263-1271, male genital structures of Deltocephalinae: 1263-1266, *Lonatura* spp.; 1267, *Amblysellus* sp.; 1268, 1269, *Graminella* spp.; 1270, 1271, *Amplicephalus* spp. 1272-1277, forewings.

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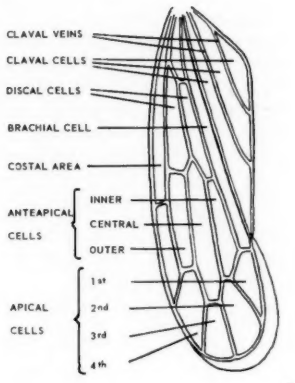


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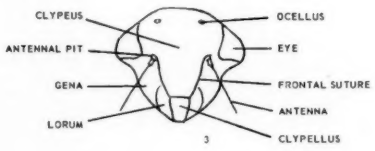


3

4

IDIOCERINAE

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KOEBELIINAE

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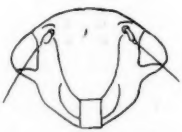

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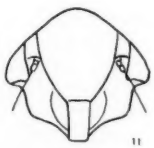

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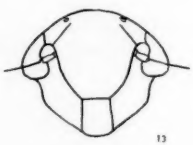

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XESTOCEPHALINAE

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DELTOCEPHALINAE

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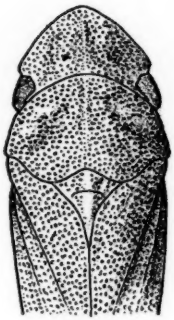
PENTHIMIINAE



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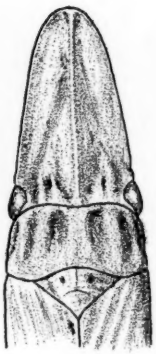

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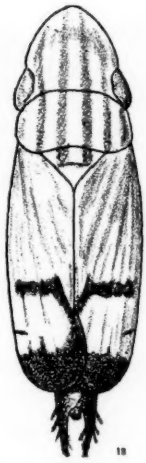

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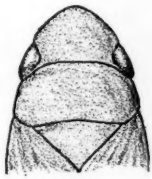

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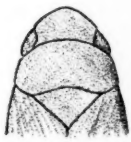

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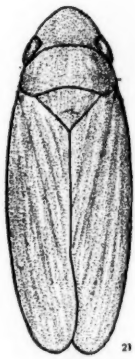

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A. NOVELLA

24

A. NOVELLINA

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A. QUADRIPUNCTATA

26

A. CALIFORNICA

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A. ARIDA

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A. UHLERI

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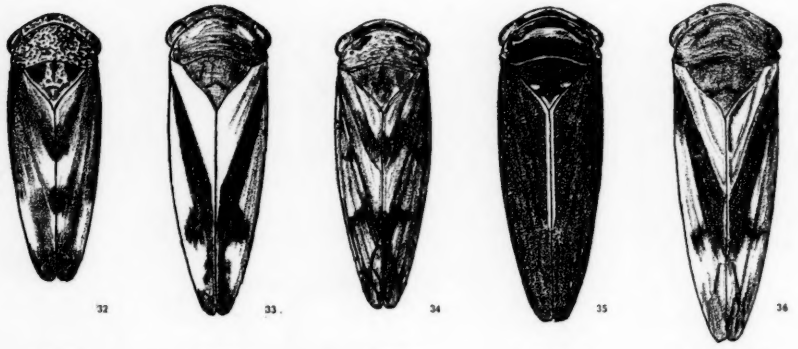
SUBSP. FUSCOSCRIPTA



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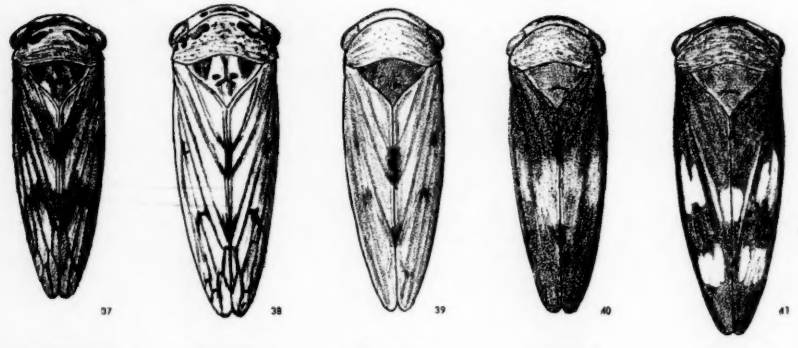

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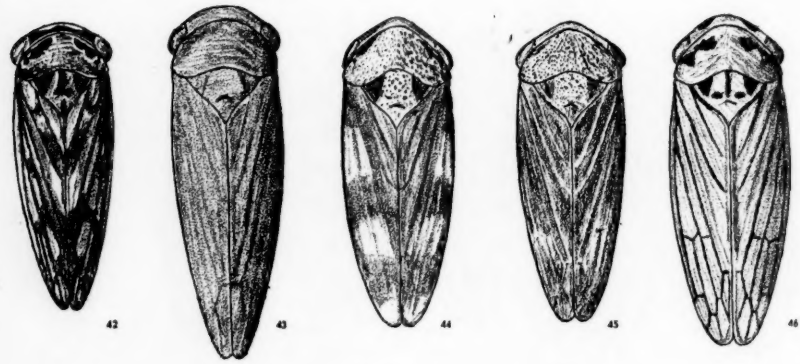

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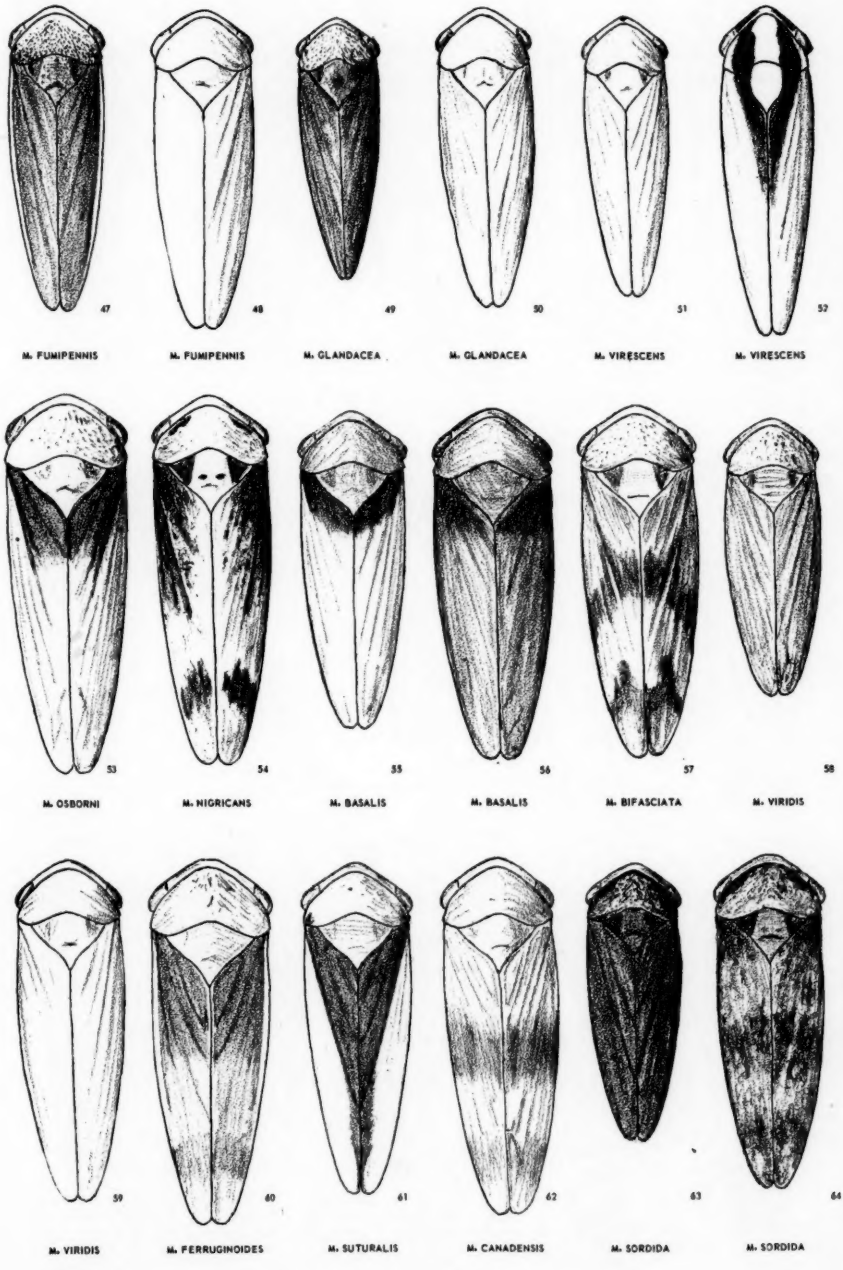
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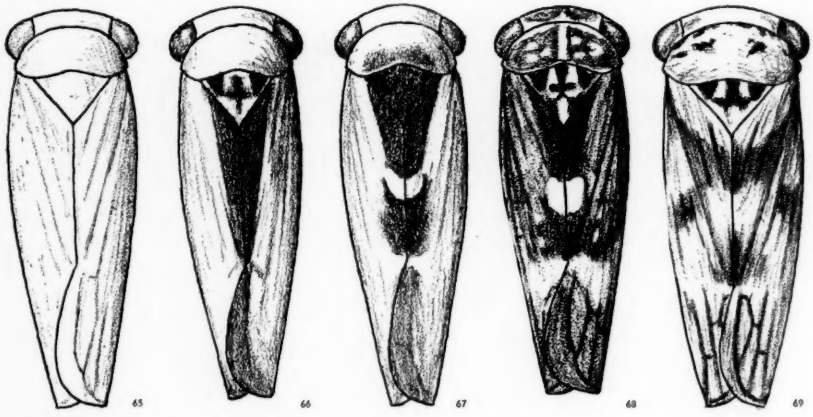


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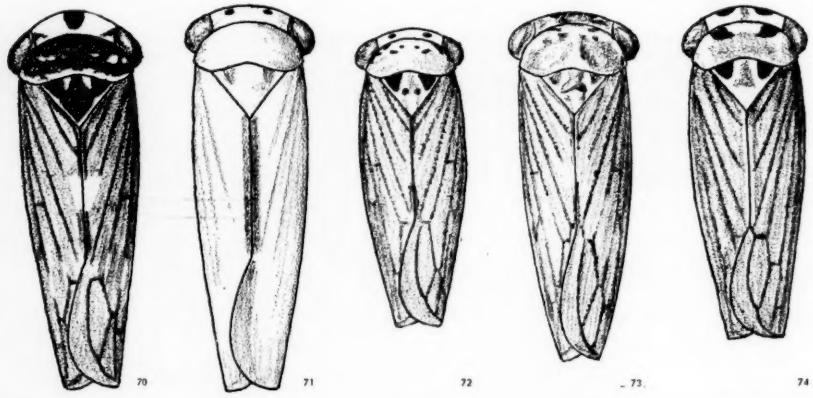


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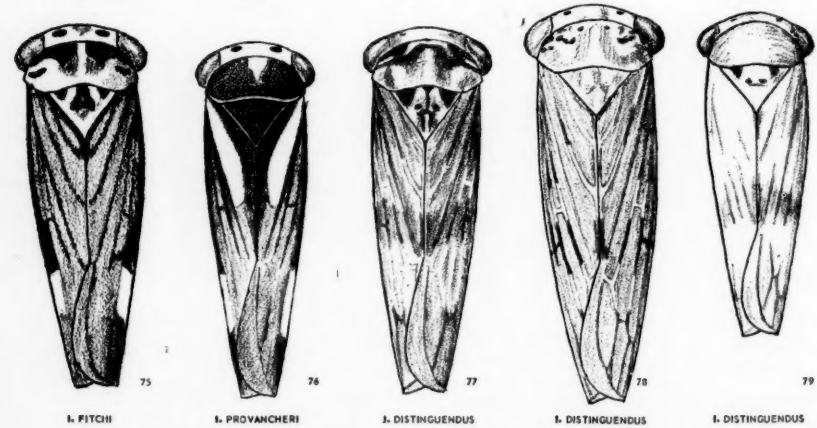


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I. ALTERNATUS

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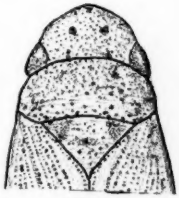

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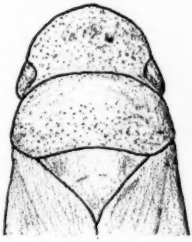

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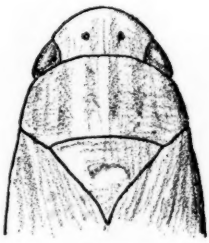

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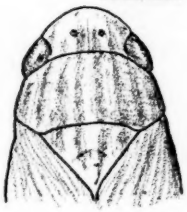

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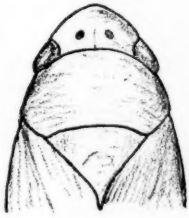

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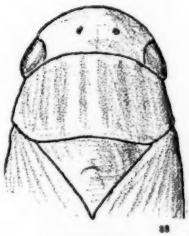

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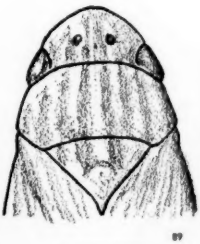

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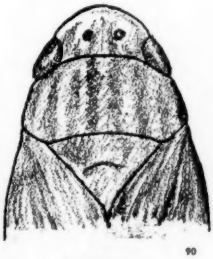

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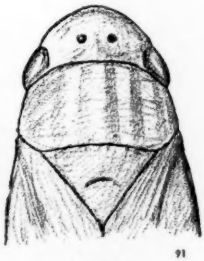

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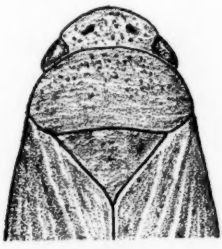

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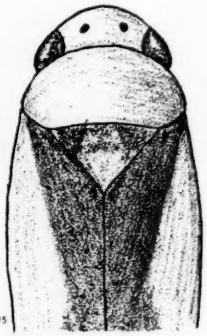

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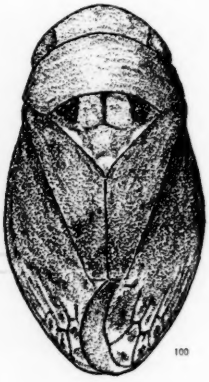

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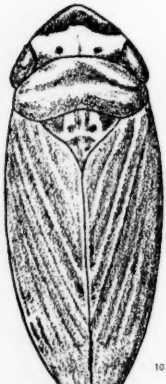

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A. FLAVOSTRIGATA

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A. FLAVOSTRIGATA

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A. FLAVOSTRIGATA

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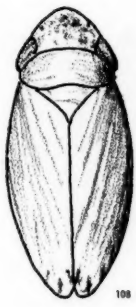
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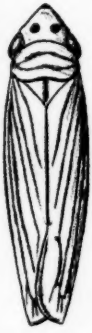
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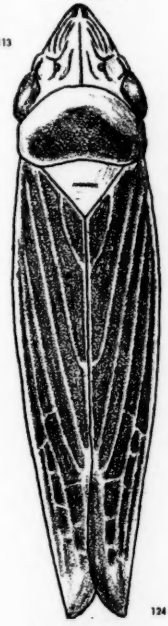
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D. MOLLIPES

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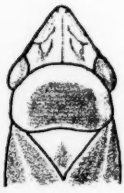

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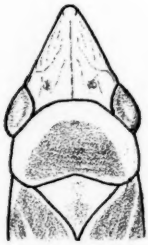

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D. PRODUCTA

128

D. CRASSICORNIS

129

D. CRASSICORNIS

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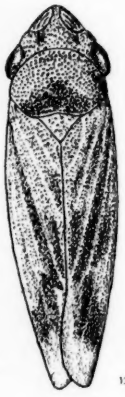
D. NOVAEBORACENSIS



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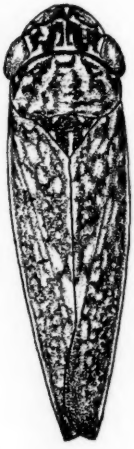

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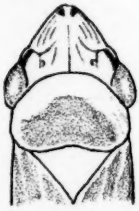

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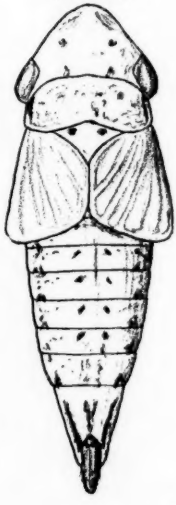

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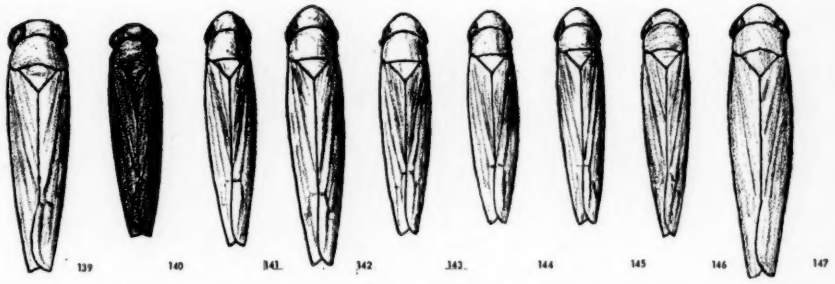

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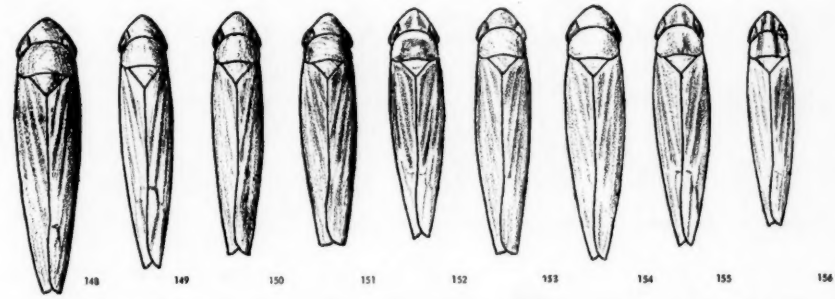

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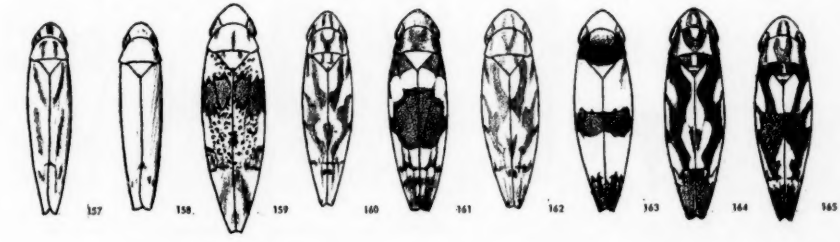

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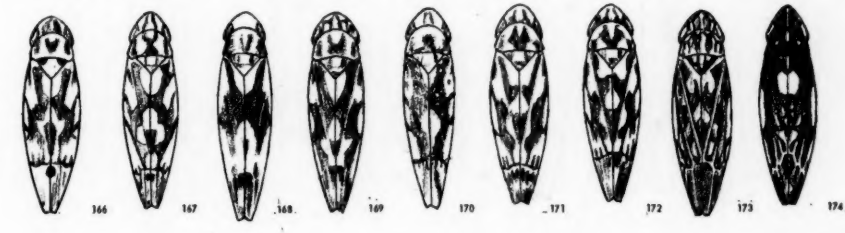

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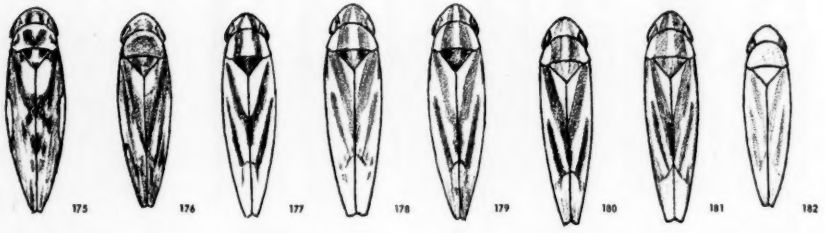


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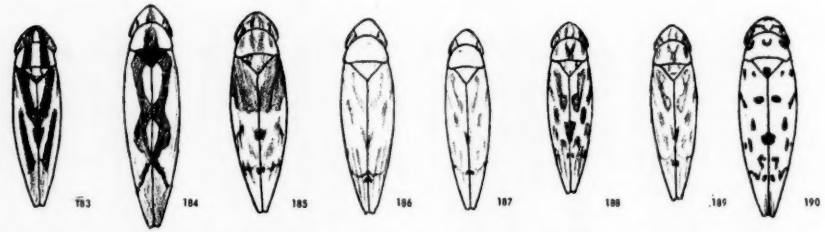


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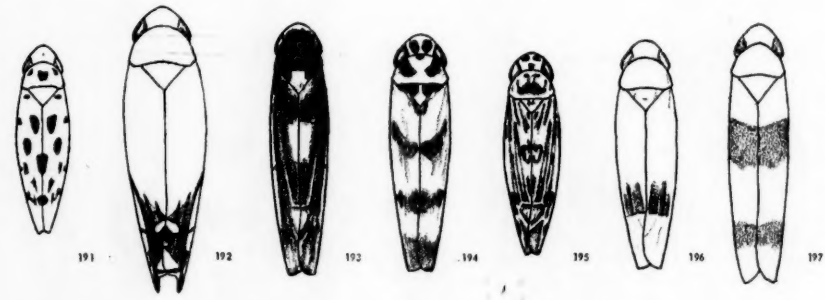


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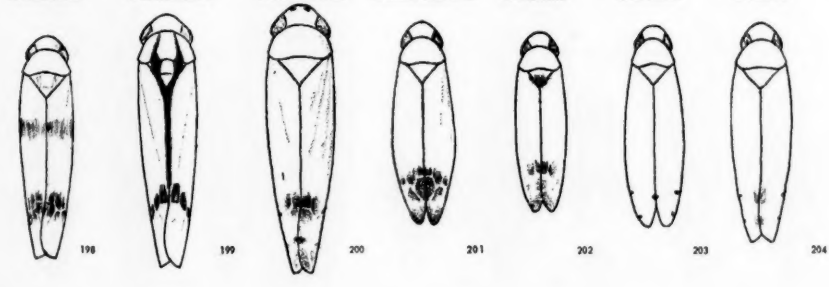


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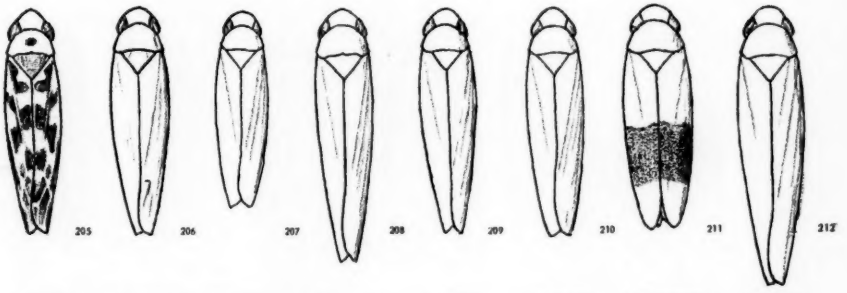

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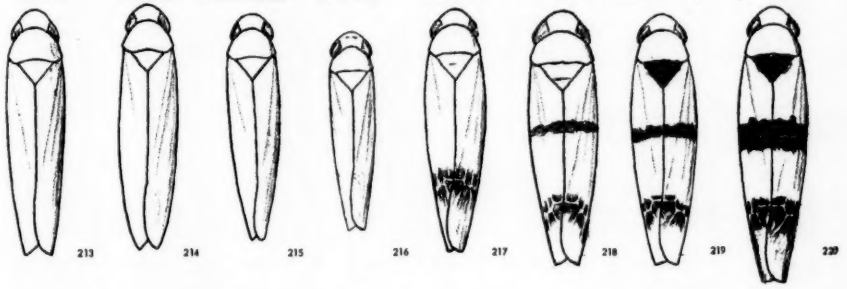

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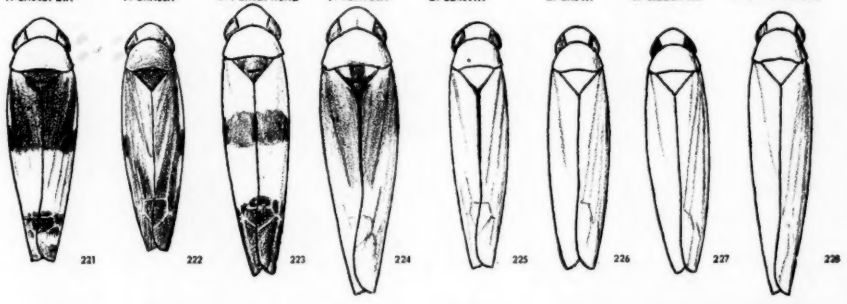

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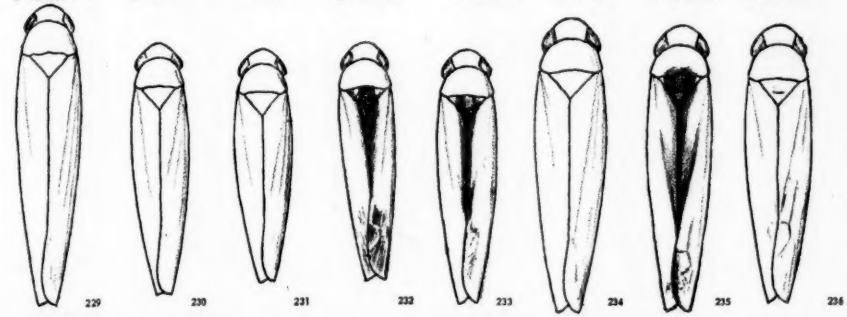

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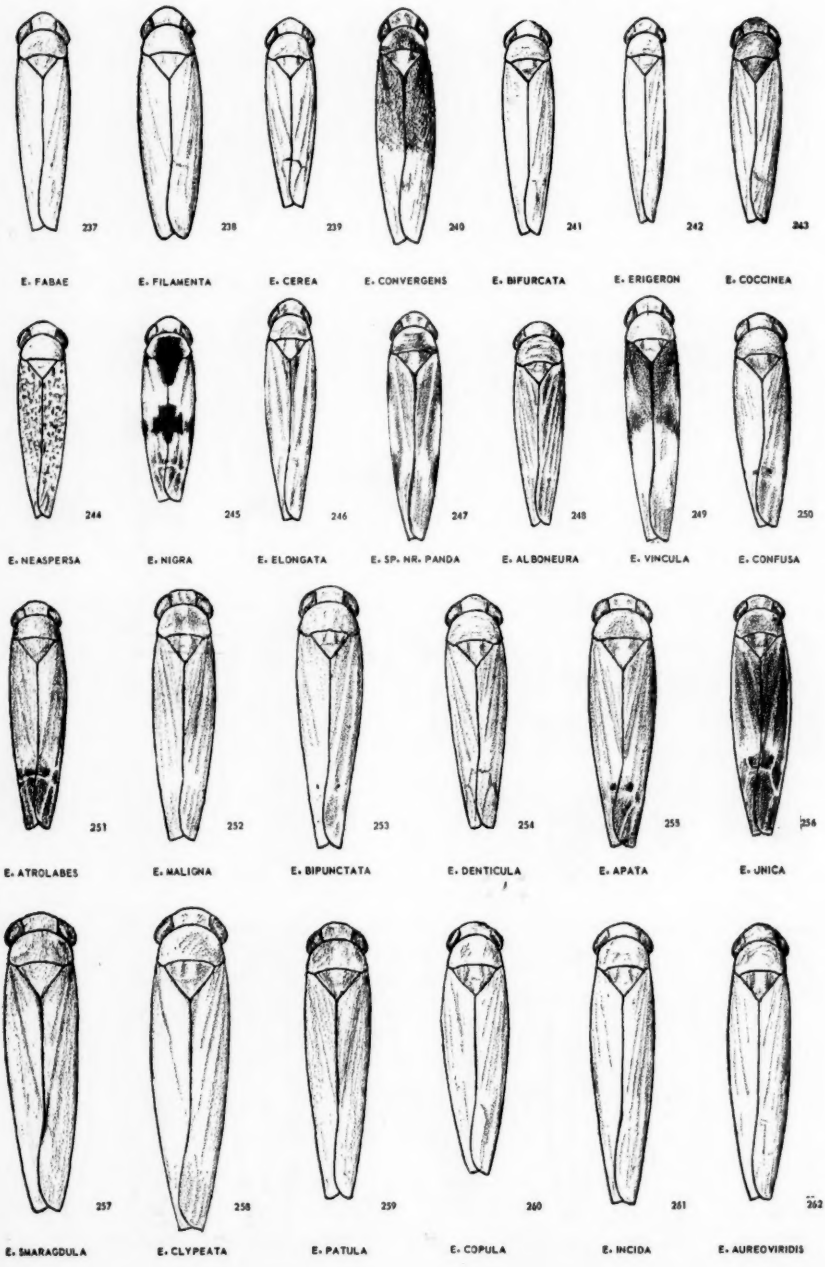
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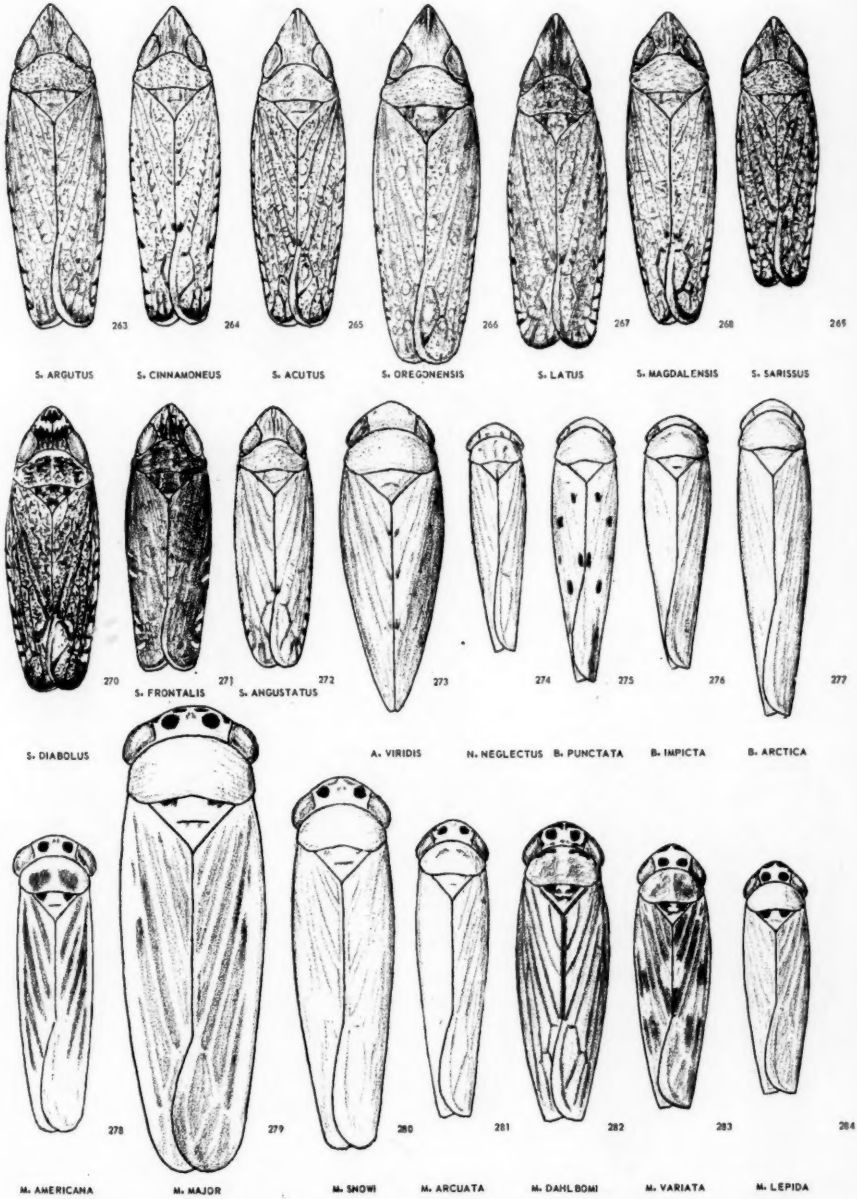
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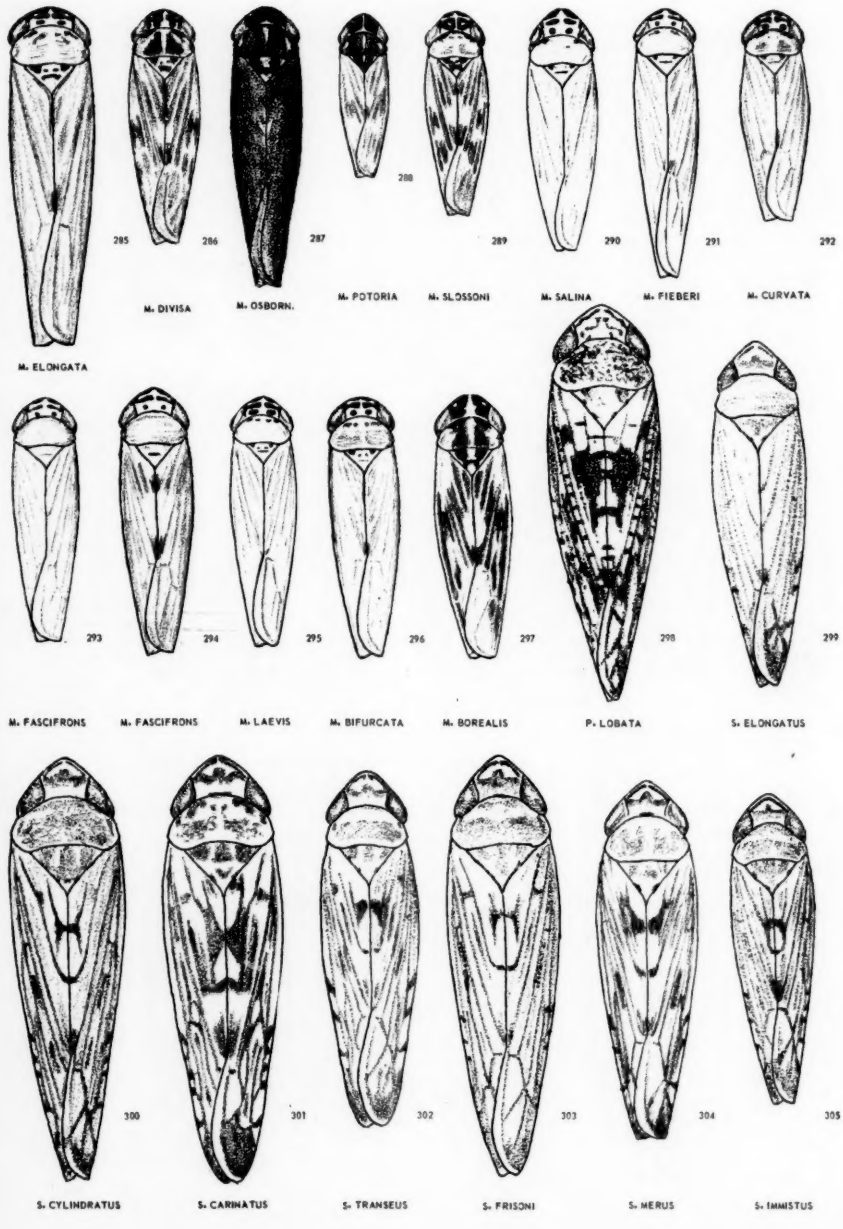
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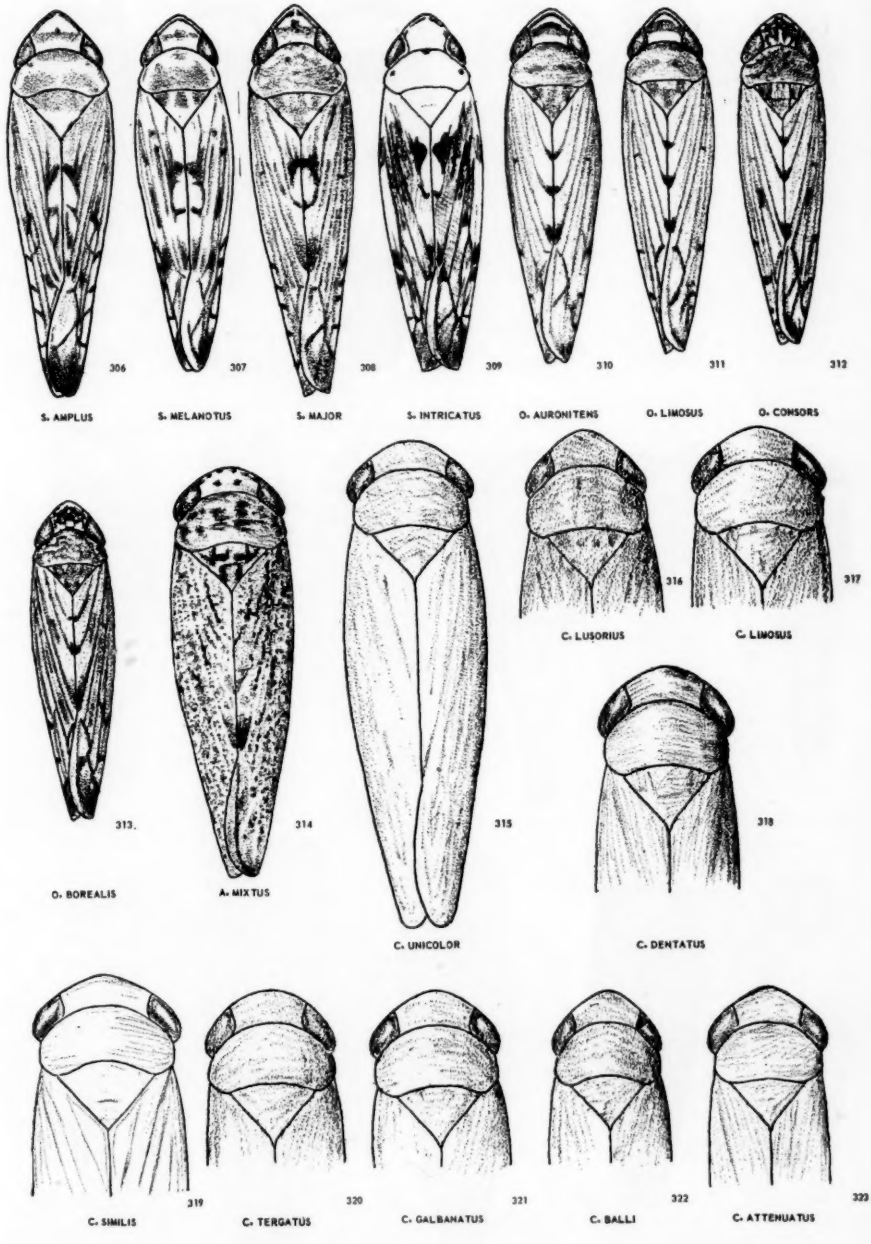
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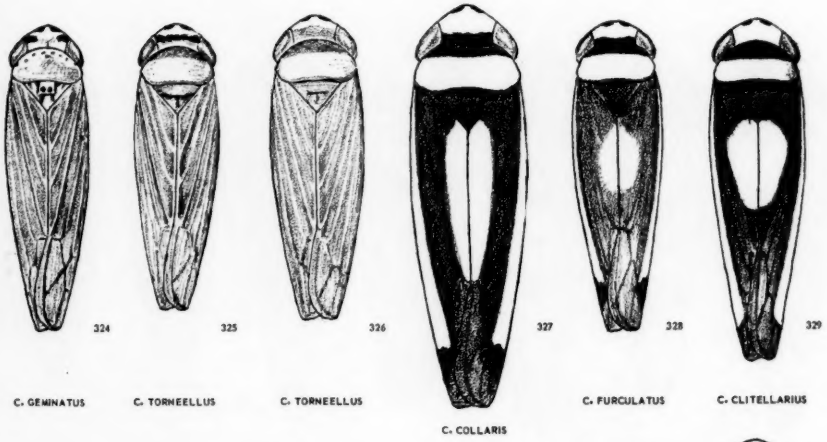
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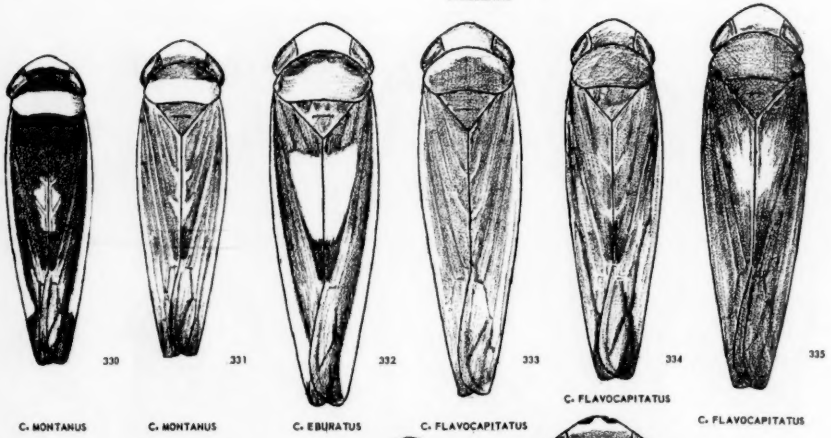
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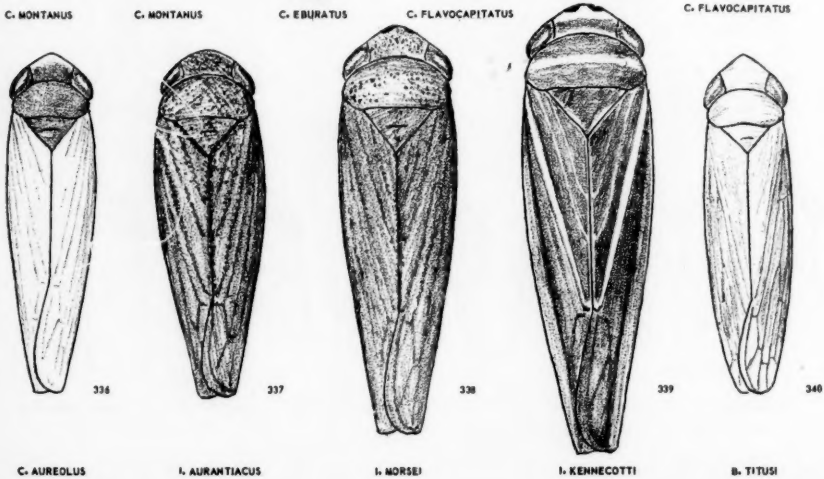
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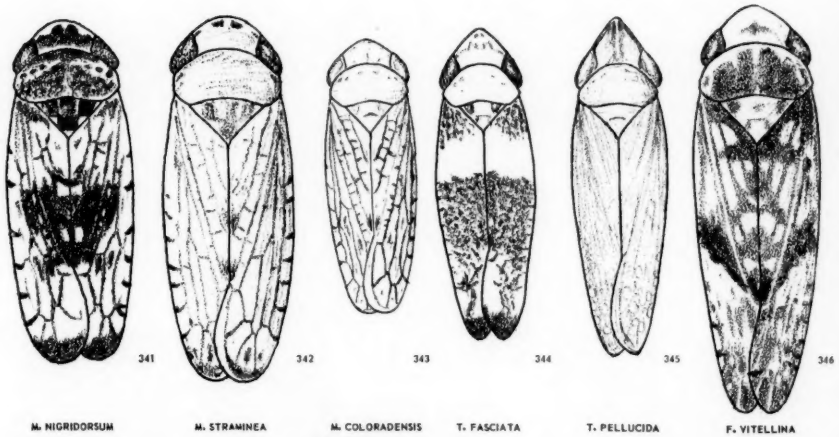
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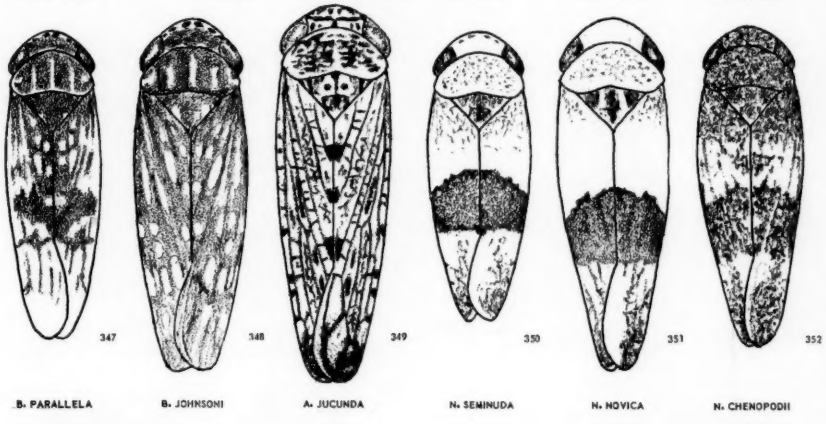
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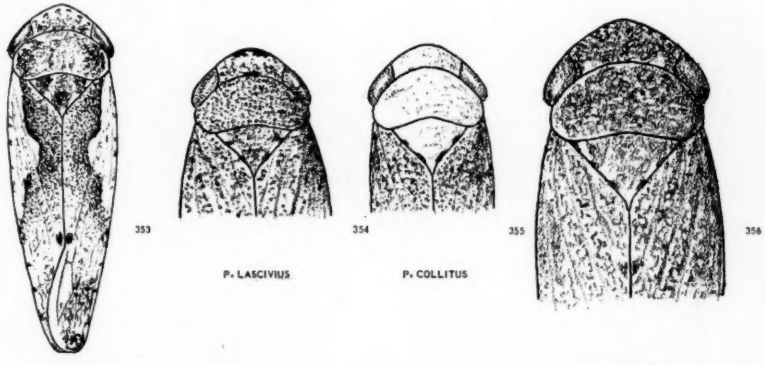
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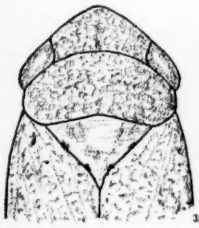

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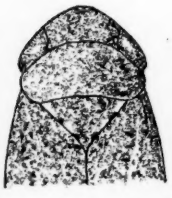

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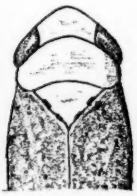

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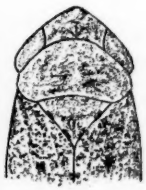

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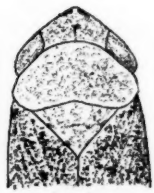

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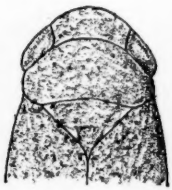
362 P. APERTUS

363 P. IRRORATUS



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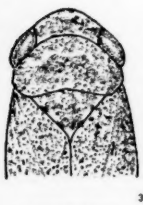
365 P. STROBI

370 T. OREGONUS



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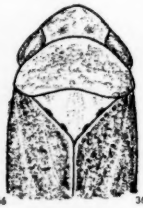

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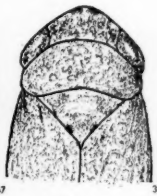

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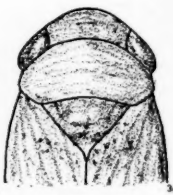

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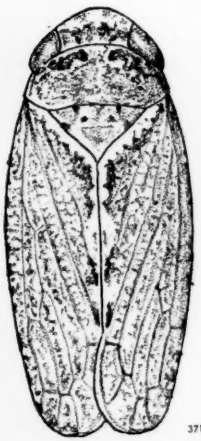
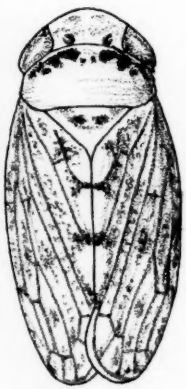


371 T. DECORUS



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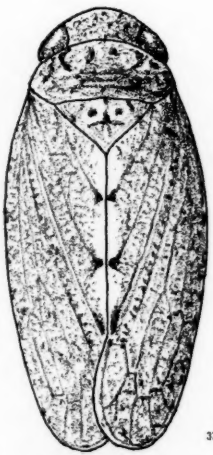
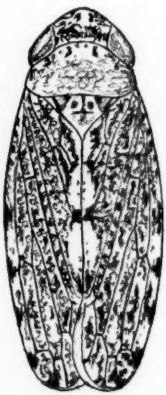


373 T. ARCTOSTAPHYLAE



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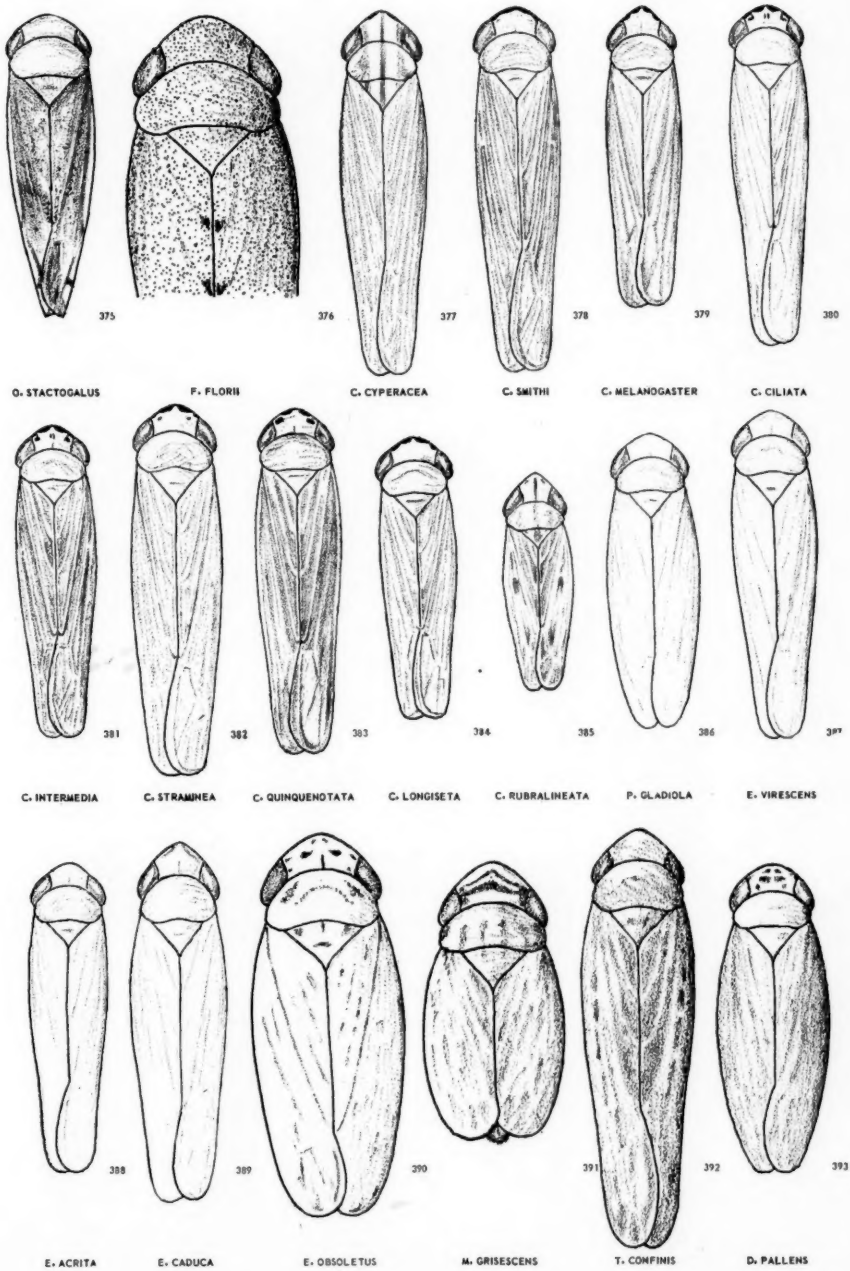
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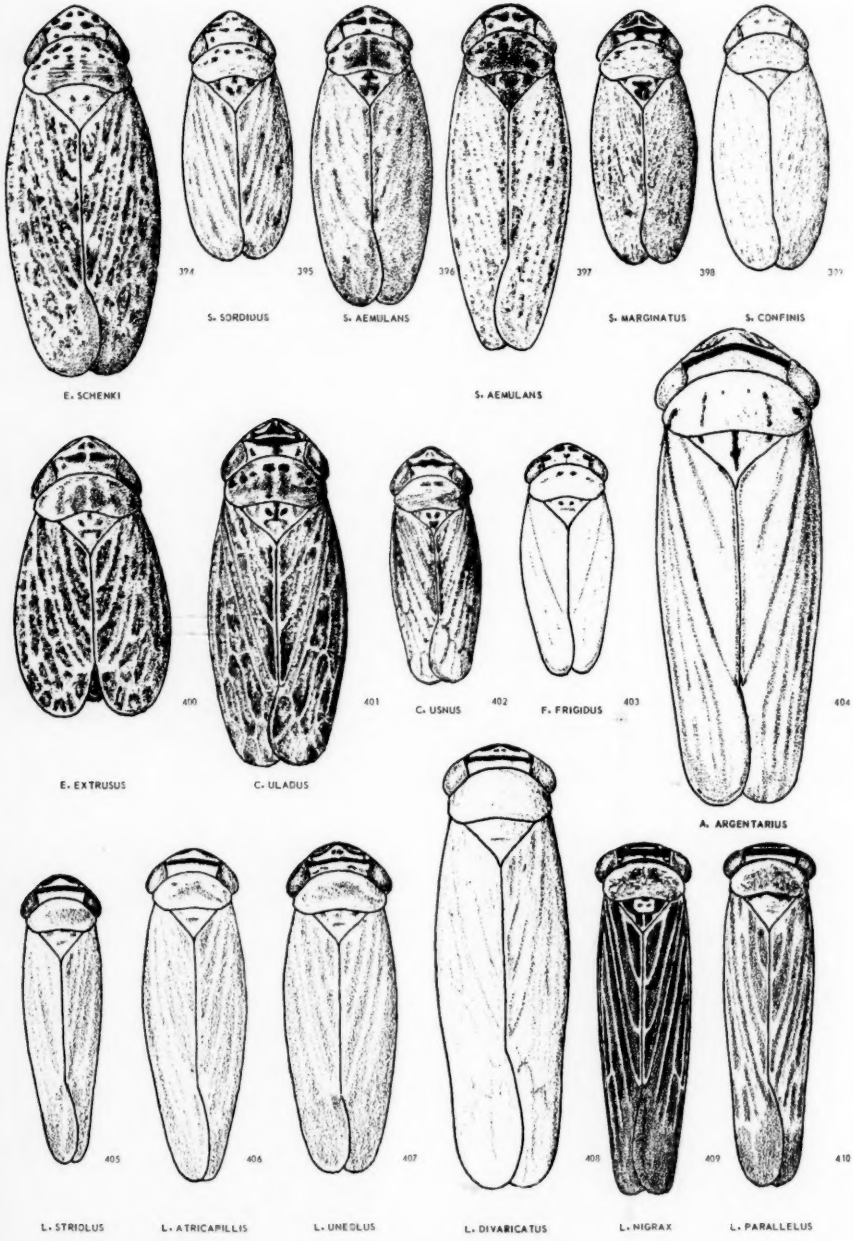
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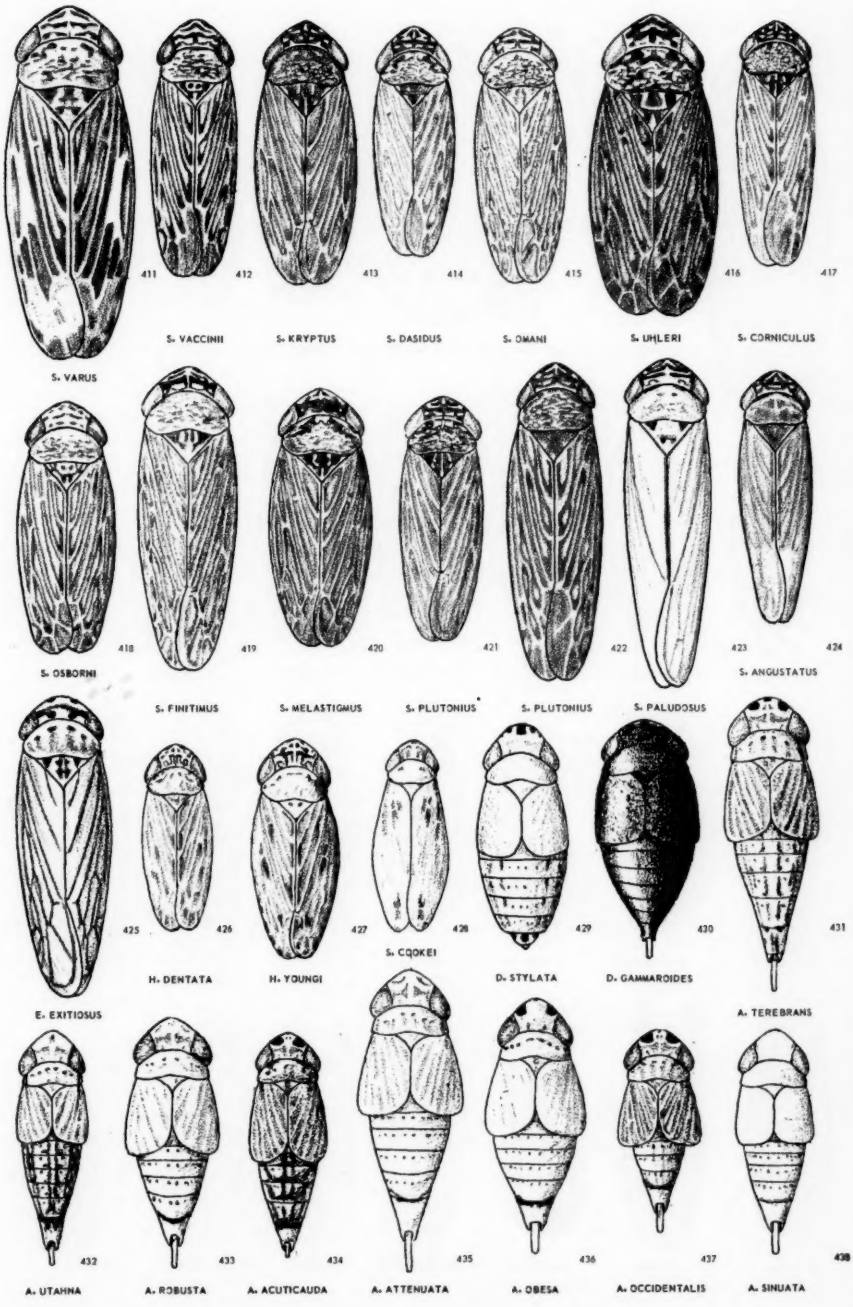
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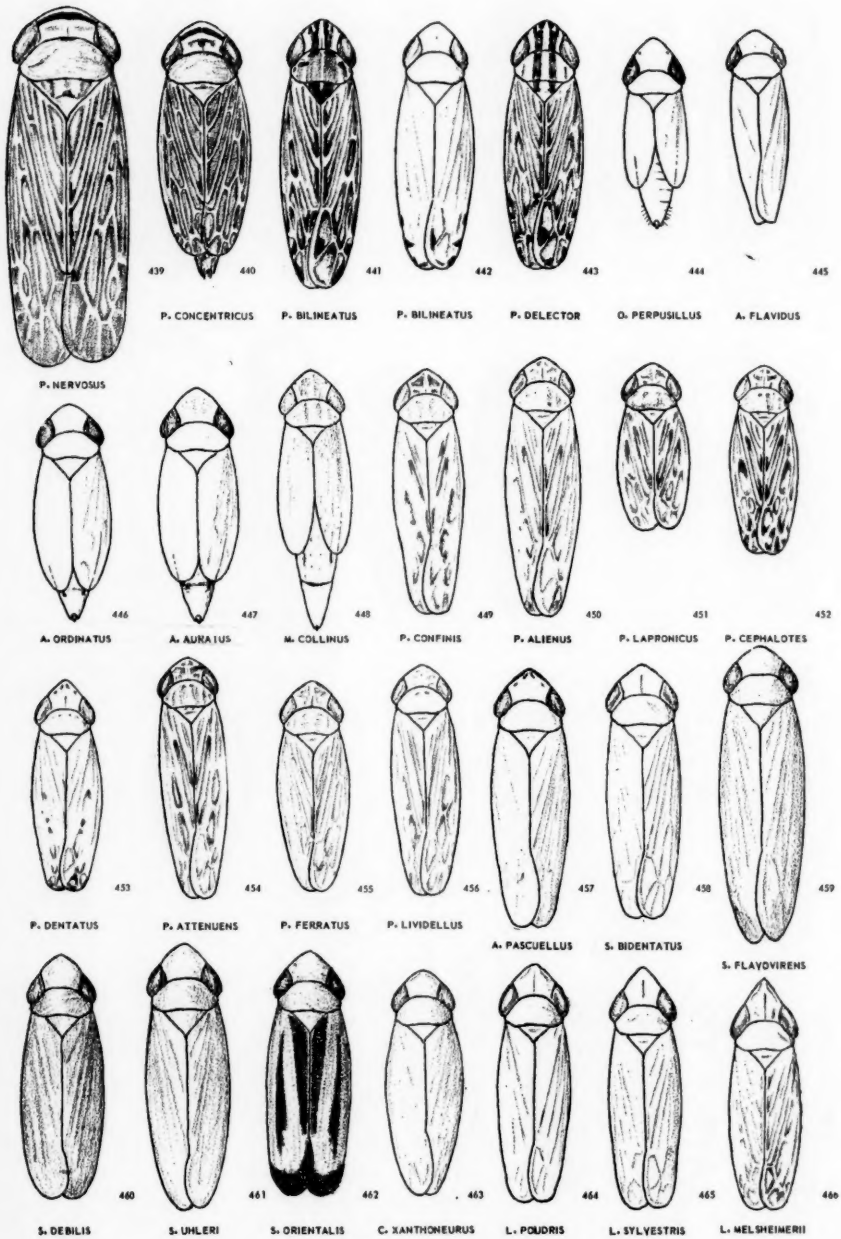
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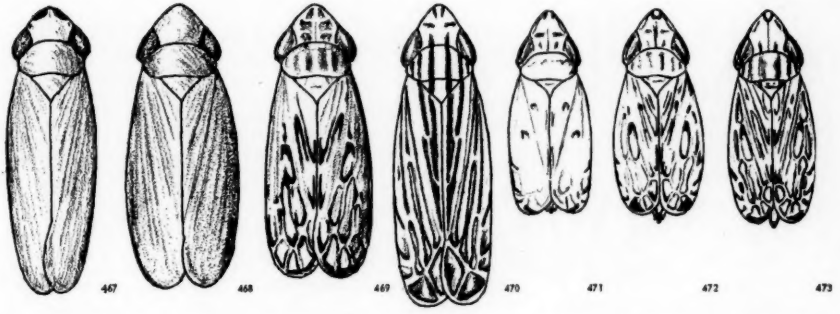

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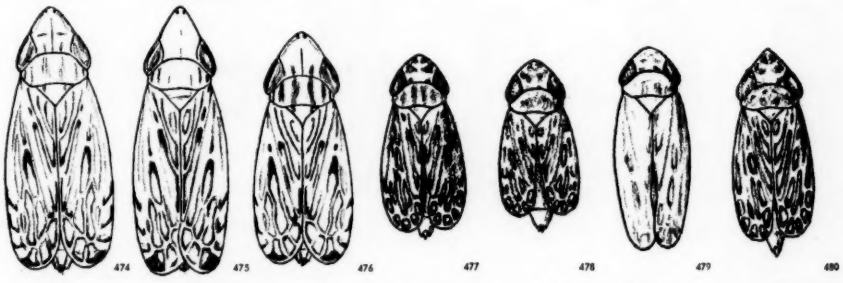

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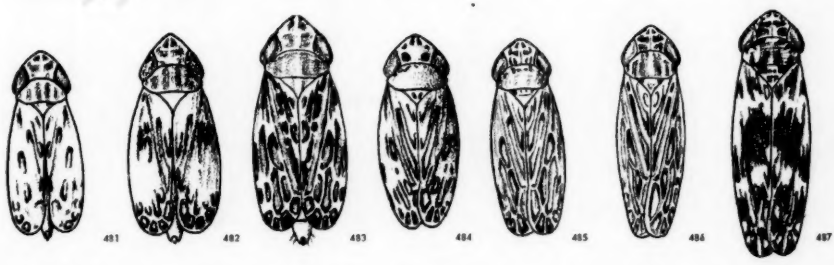

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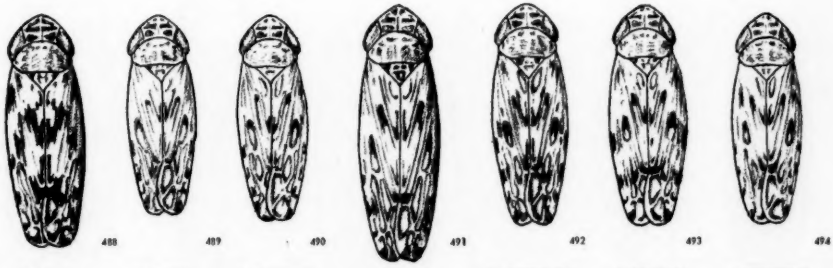

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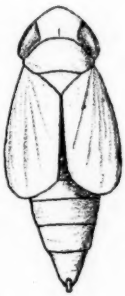
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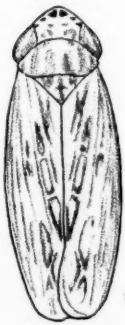
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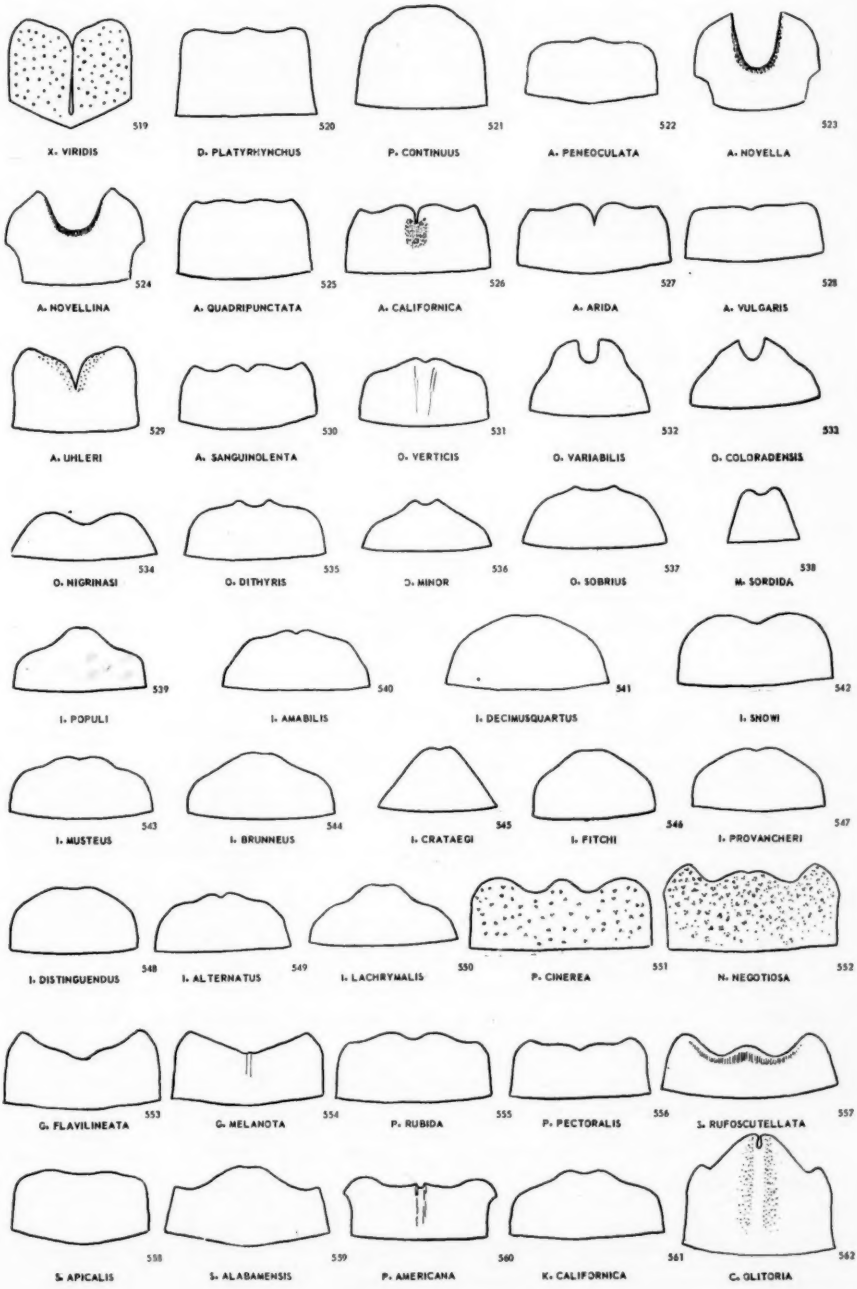
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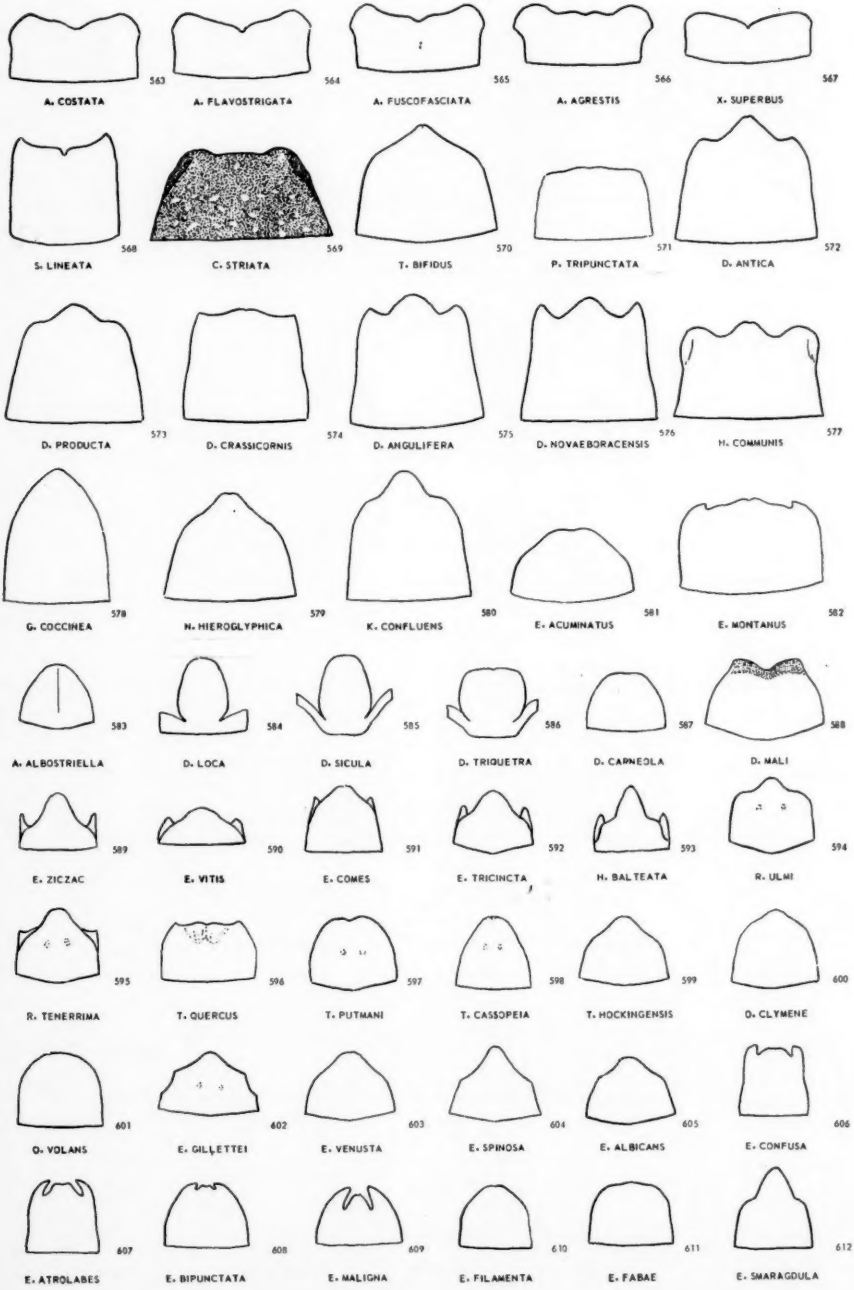
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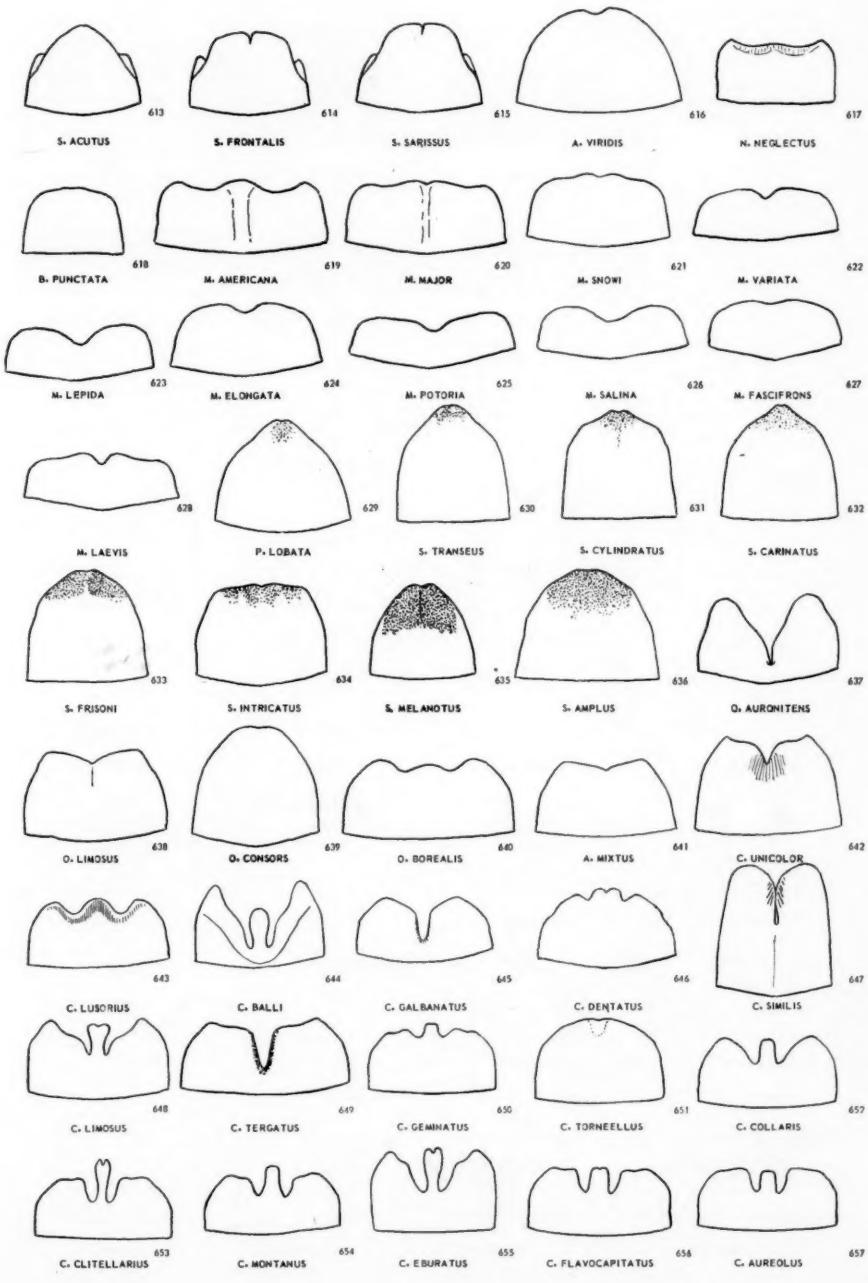
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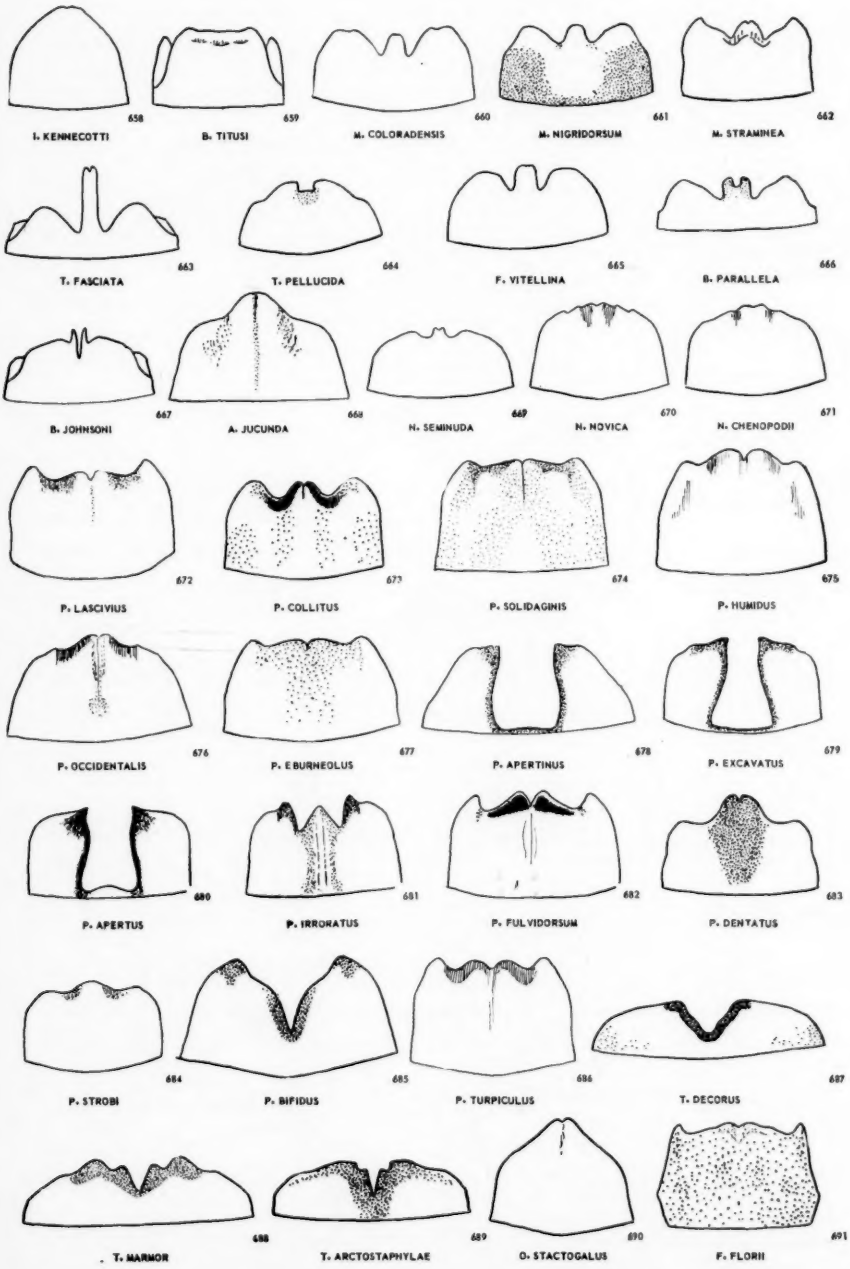
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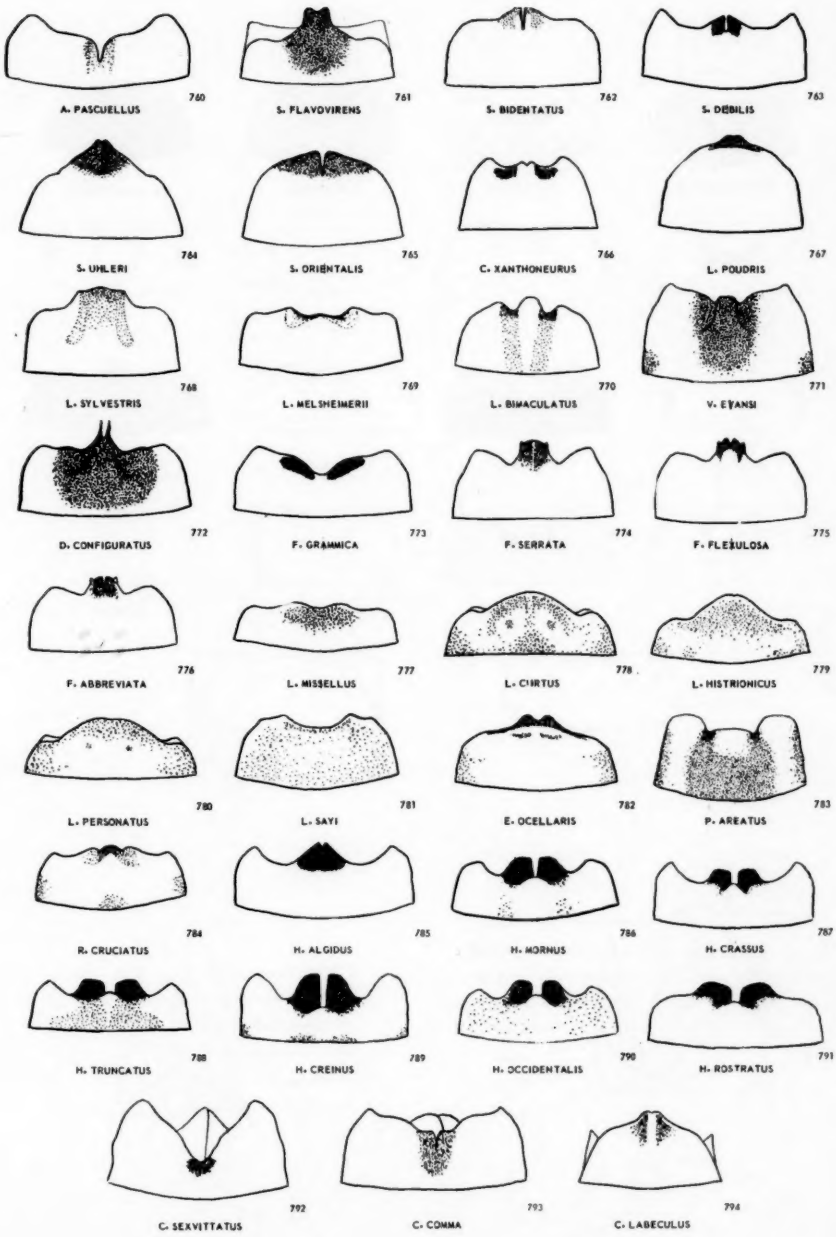
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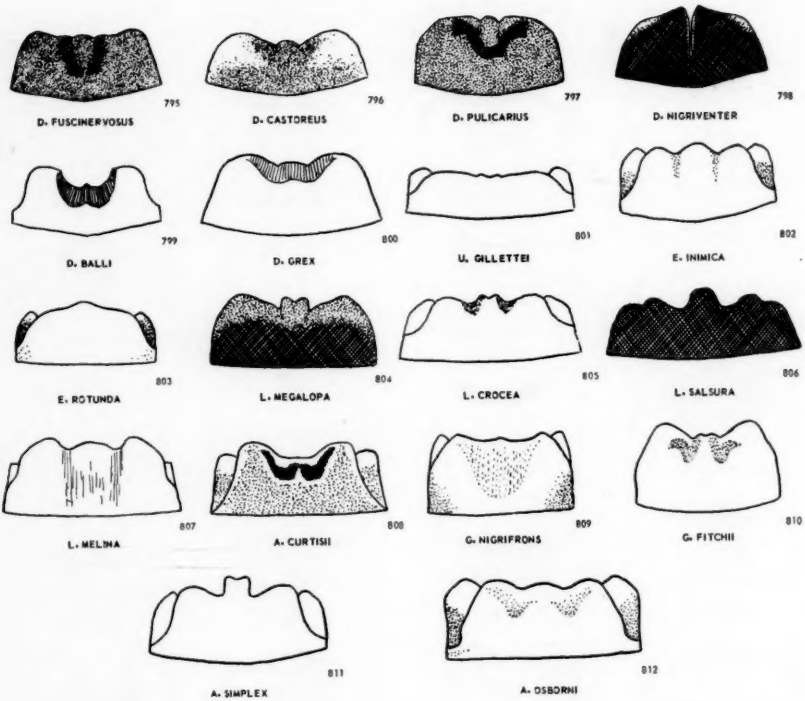
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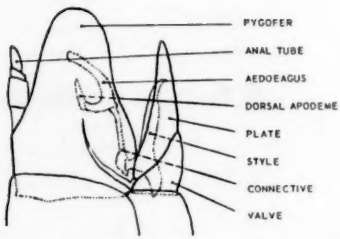
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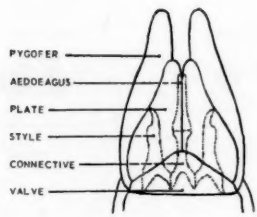
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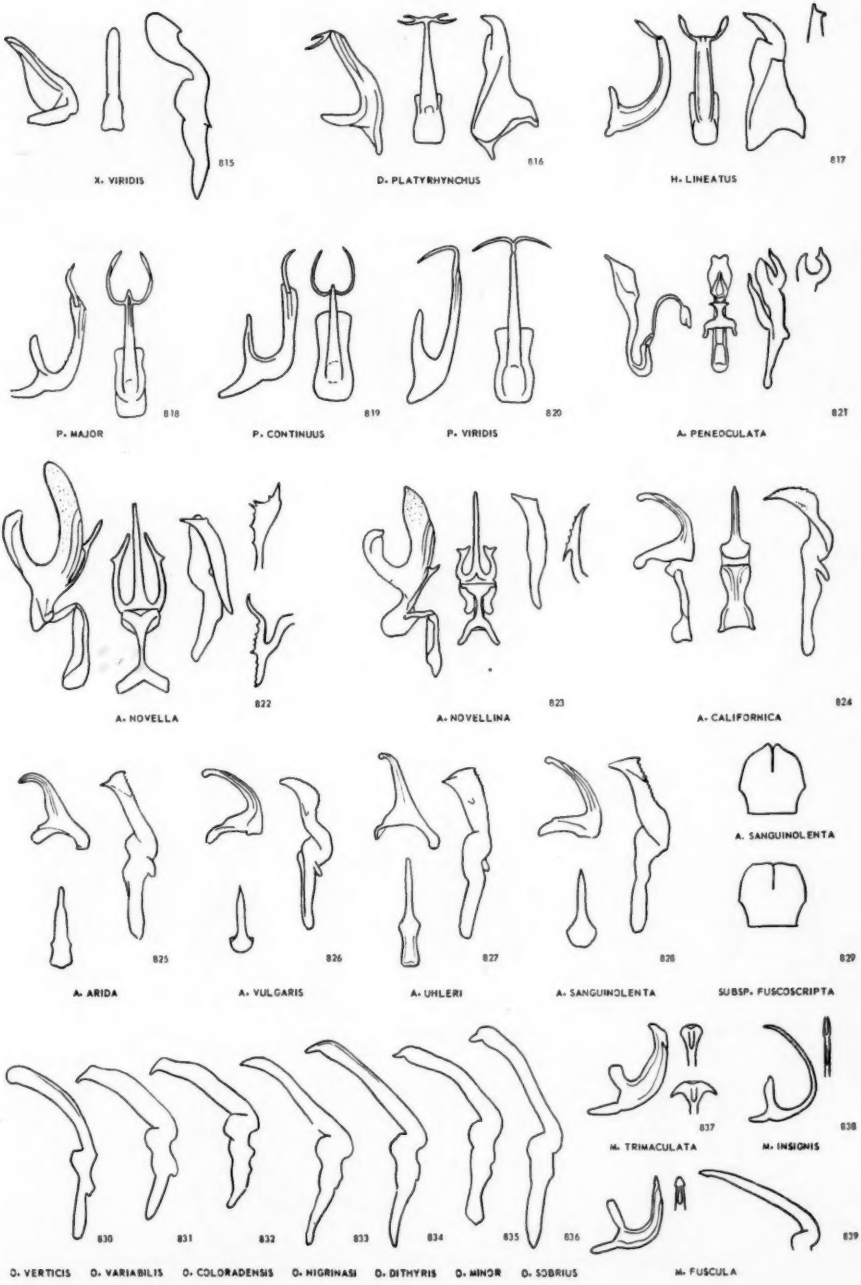
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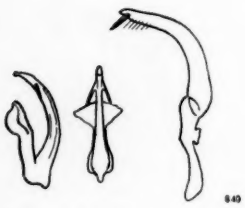
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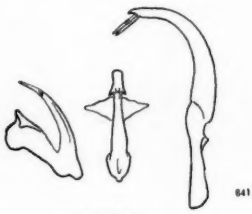
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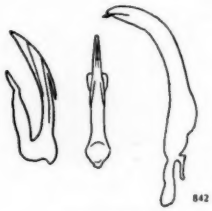
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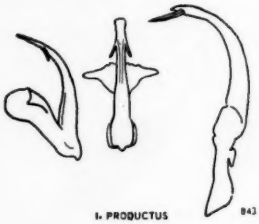
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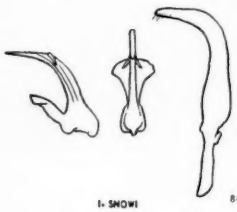
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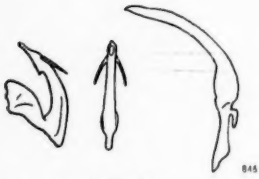
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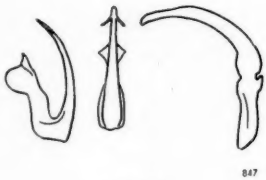
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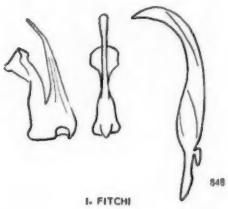
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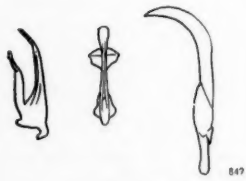
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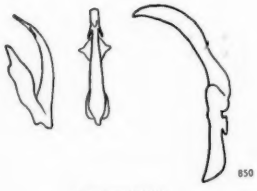
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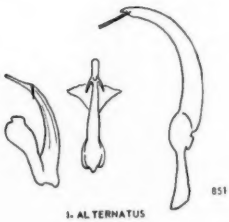
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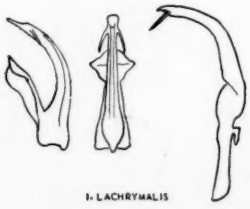
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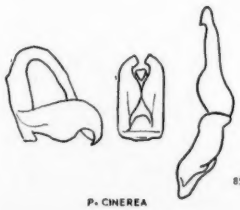
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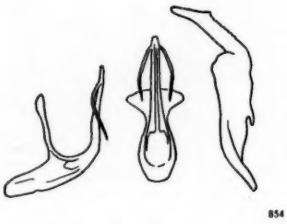
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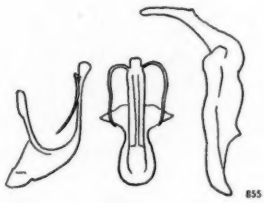
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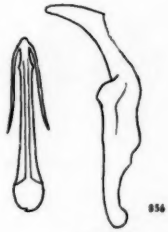
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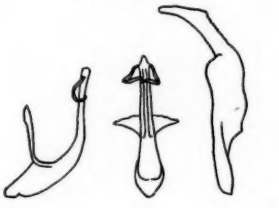
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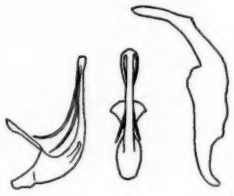
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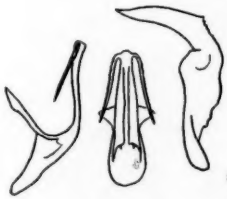
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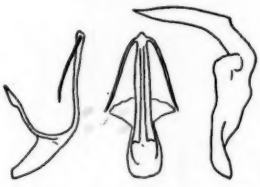
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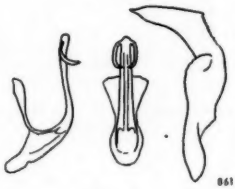
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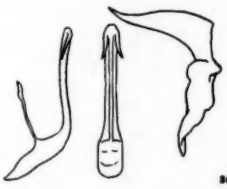
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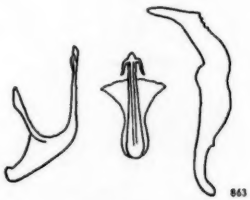
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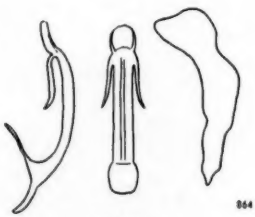
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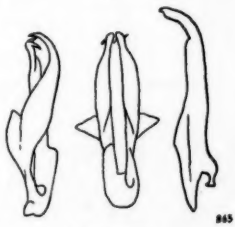
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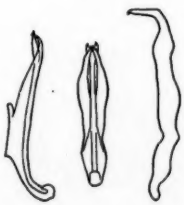
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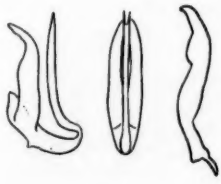
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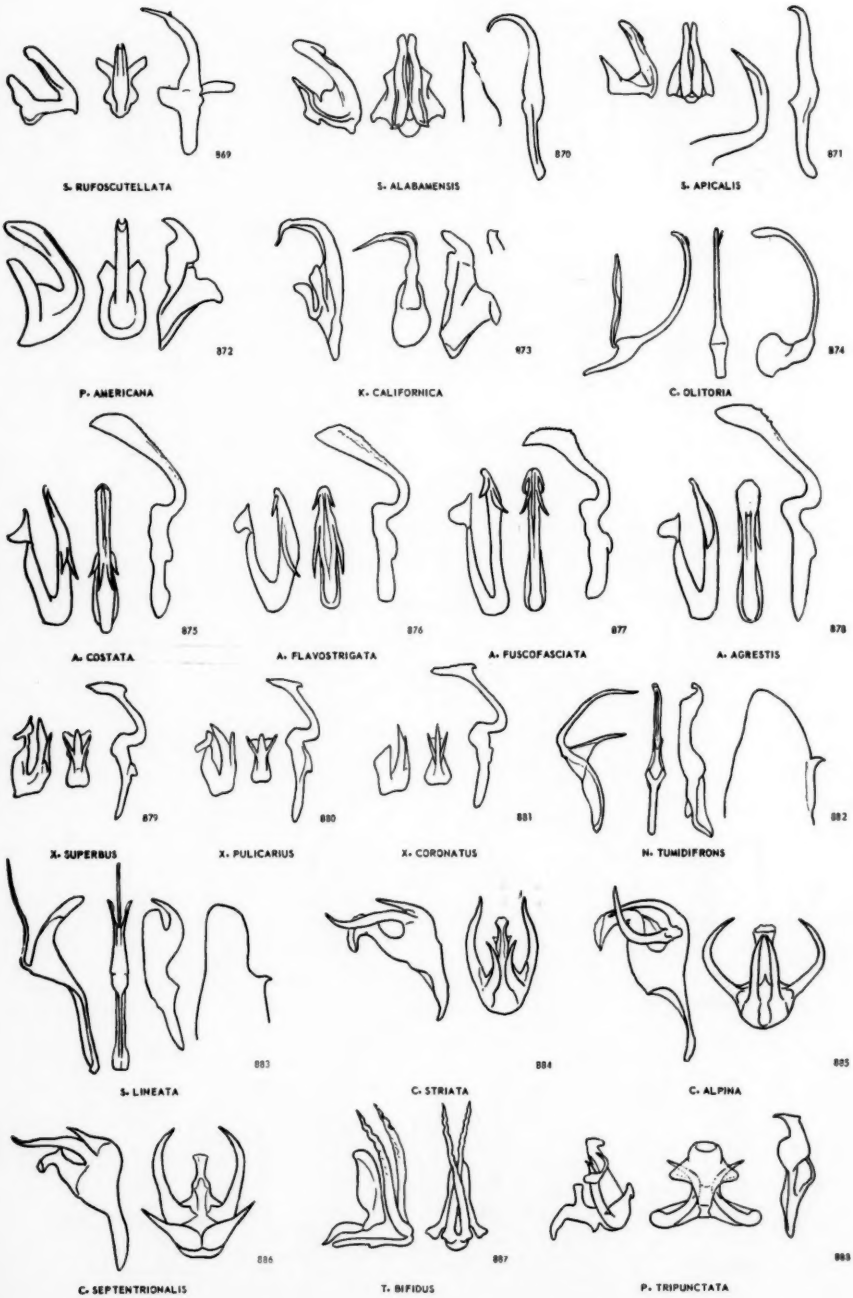
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A. FLAVOSTRIGATA
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A. FUSCOFASCIATA
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A. AGRESTIS
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X. CORONATUS
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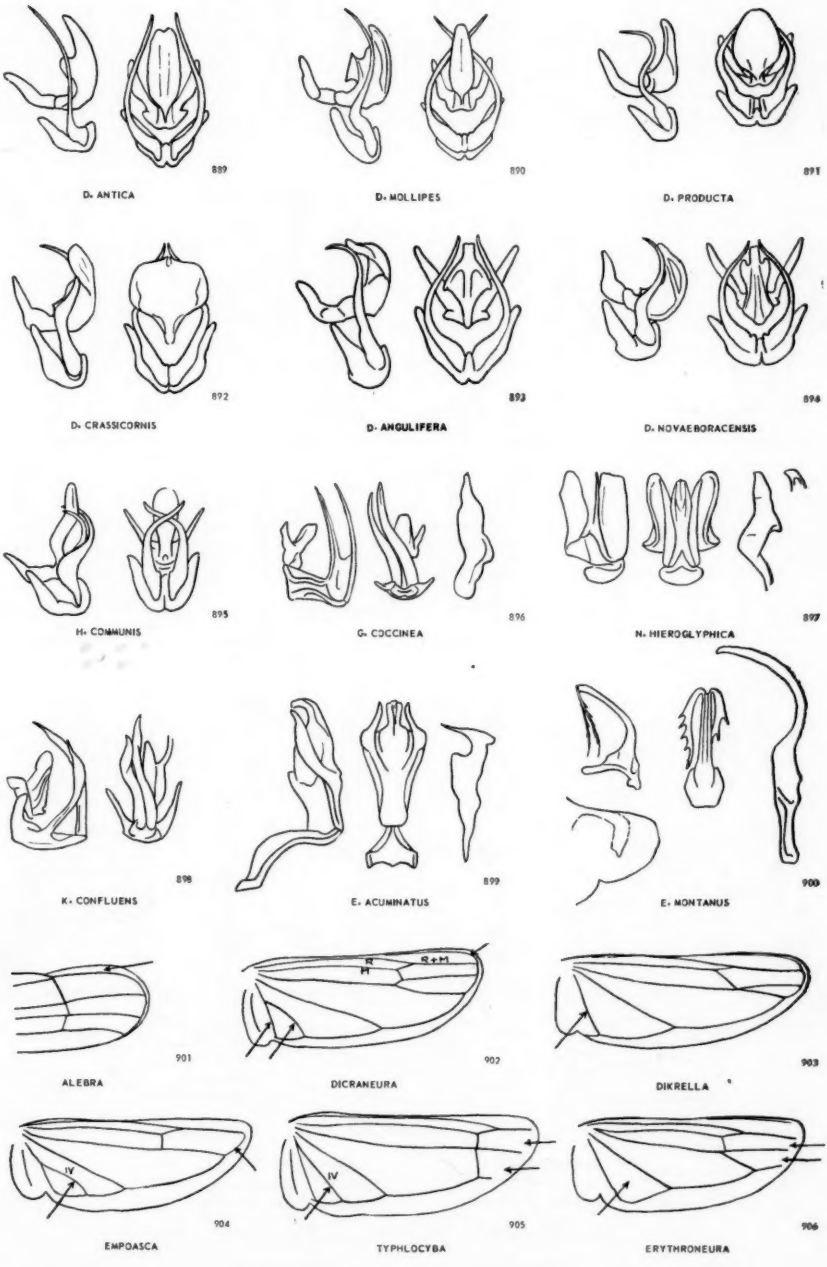
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D. NOVAEBORACENSIS
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H. COMMUNIS
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G. COCCINEA
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N. HIEROGLYPHICA
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K. CONFLUENS
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E. MONTANUS
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DICRANEURA
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DIKRELLA
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EMPOASCA
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TYPHLOCYBA
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ERYTHRONEURA

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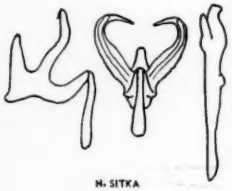
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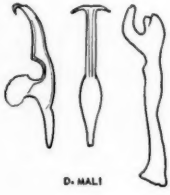
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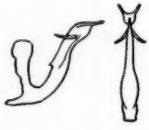
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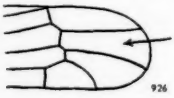
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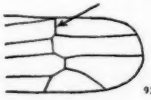
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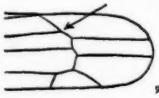
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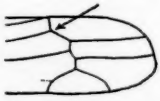
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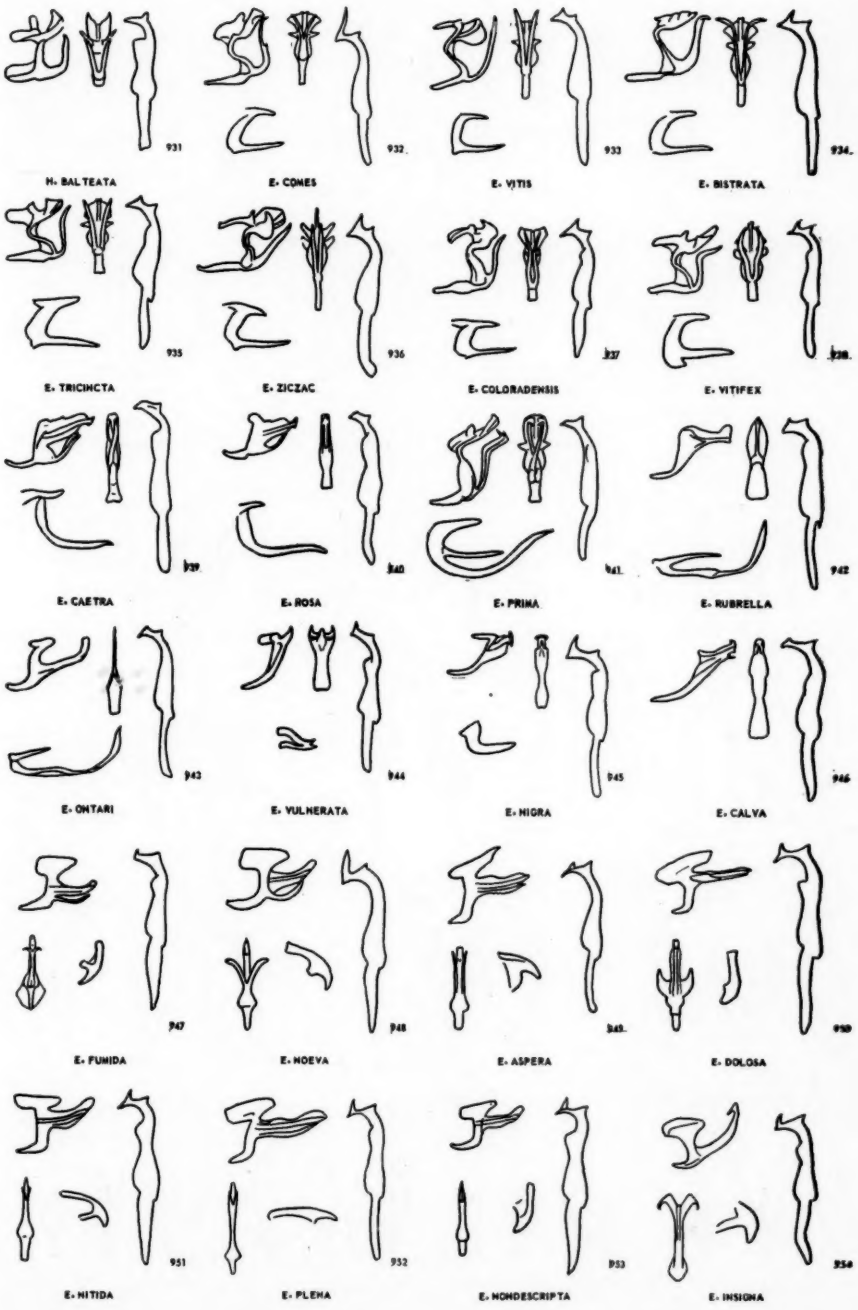
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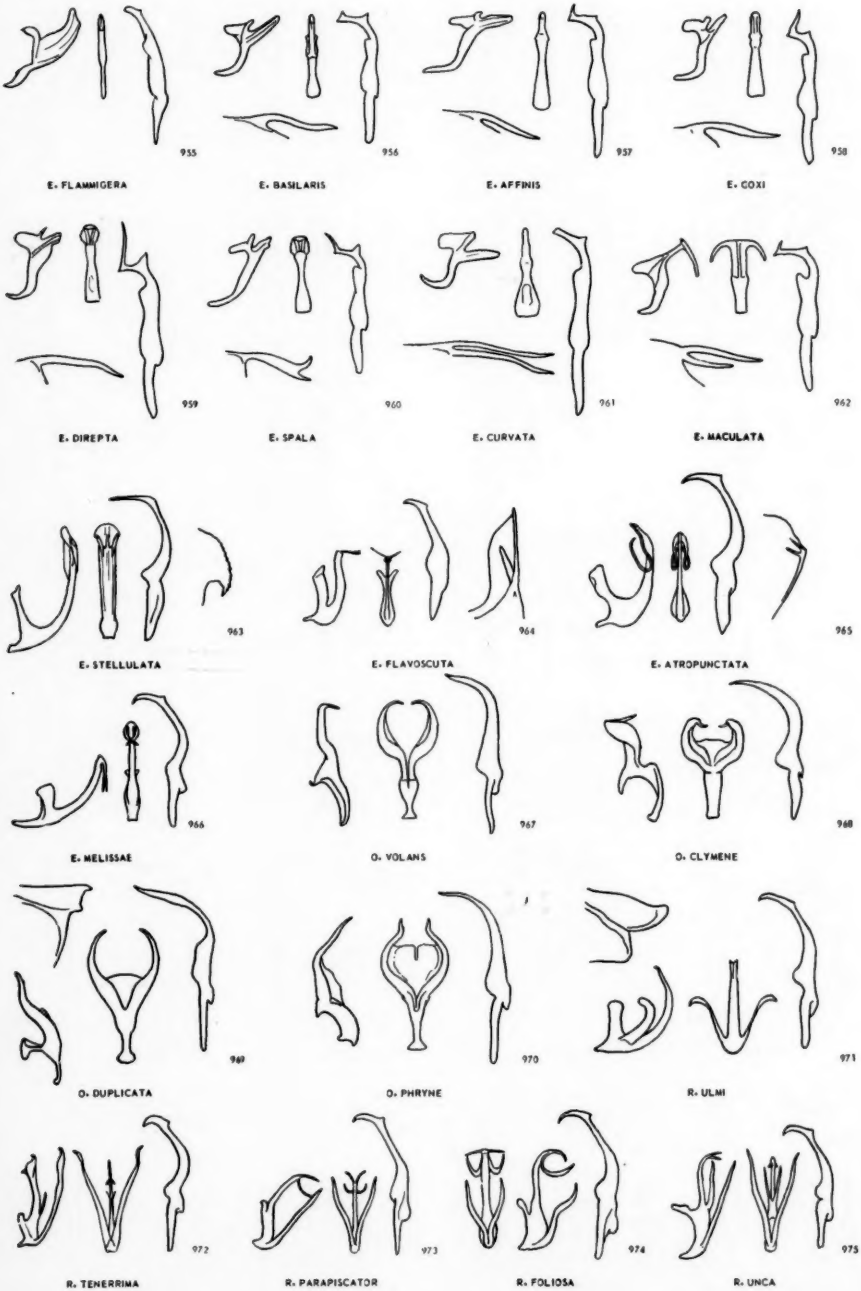
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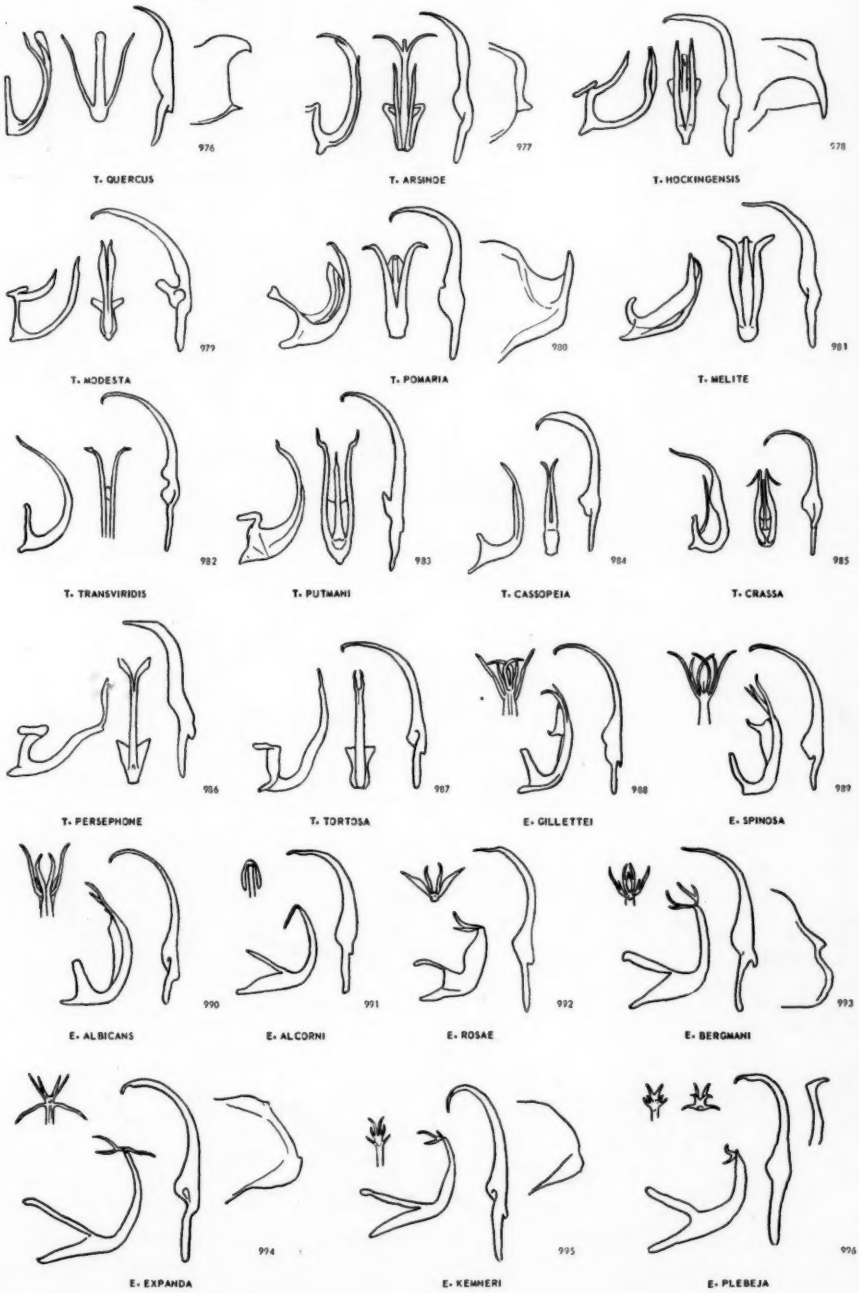
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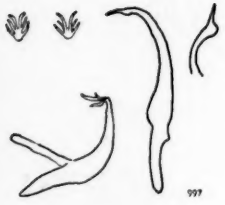
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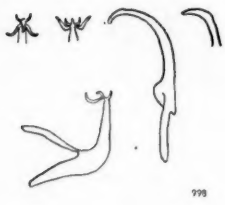
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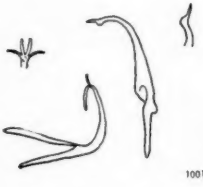
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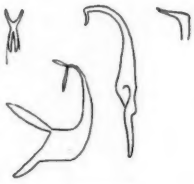
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1008
E. ERIGERON

1009
E. COCCINEA

1010
E. NEASPERSA

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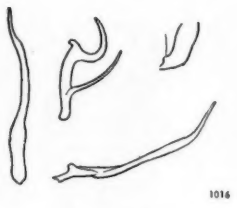

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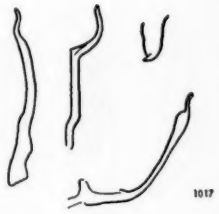

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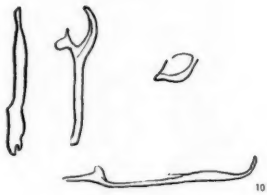

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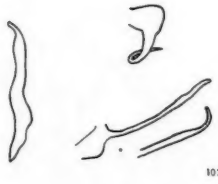

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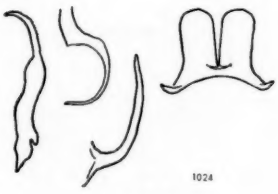

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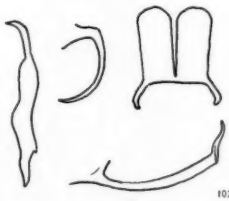

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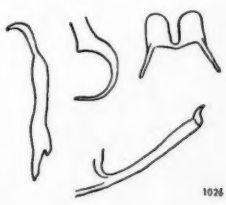

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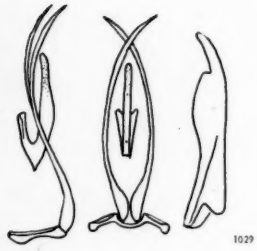
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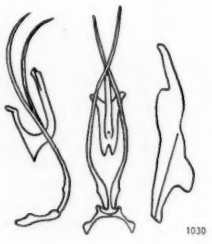
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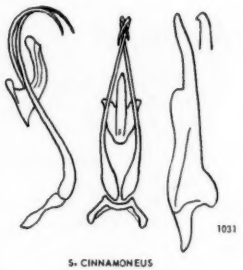
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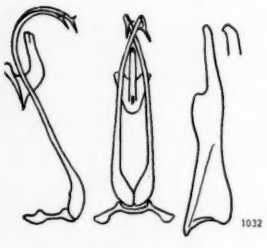
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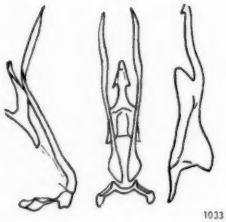
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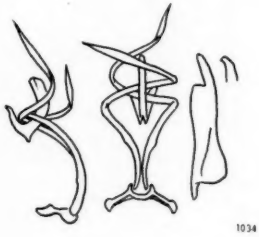
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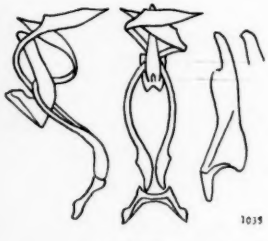
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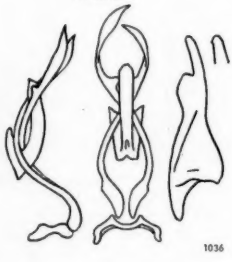
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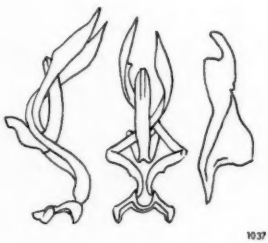
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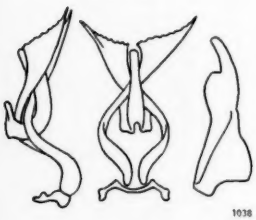
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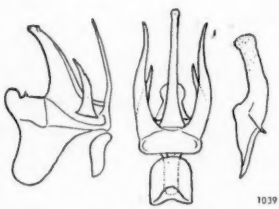
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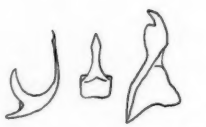
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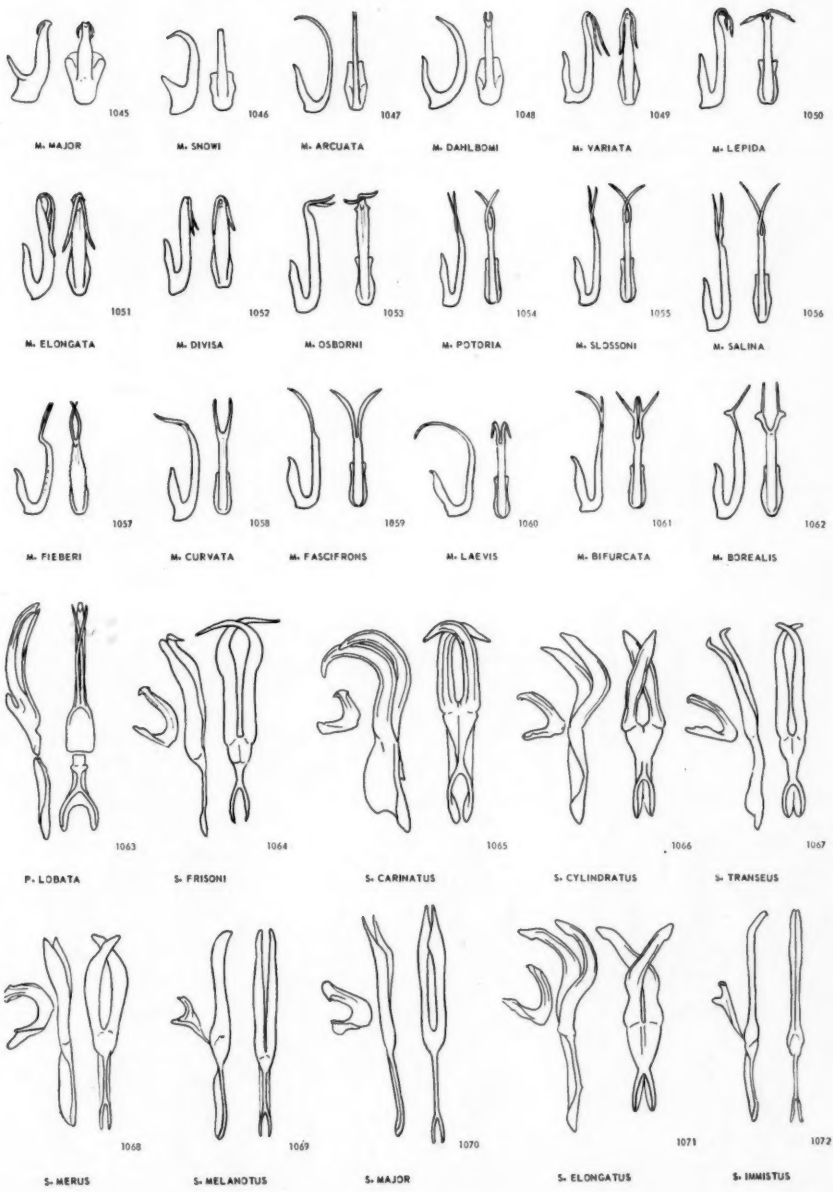
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M. POTORIA
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M. SLOSSONI
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M. BIFURCATA
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P. LOBATA
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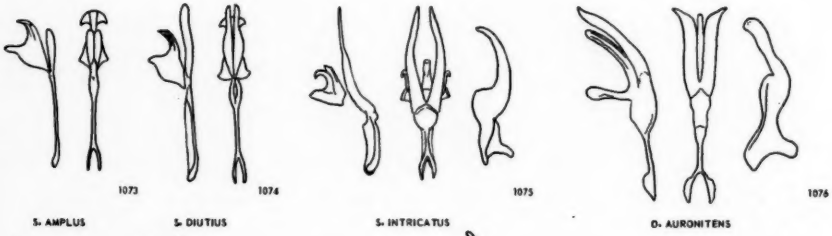


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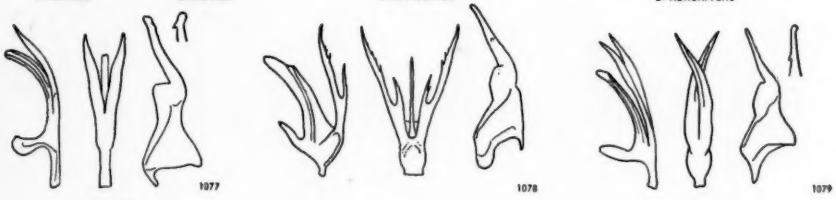


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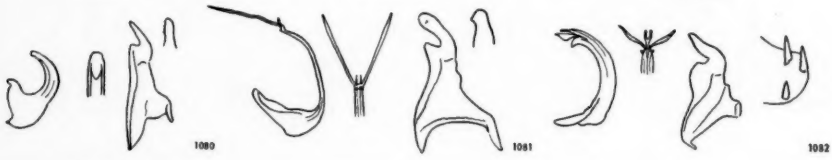


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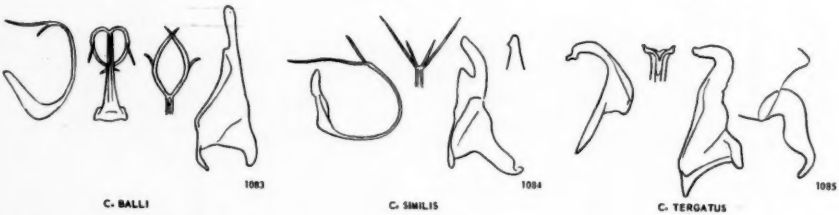


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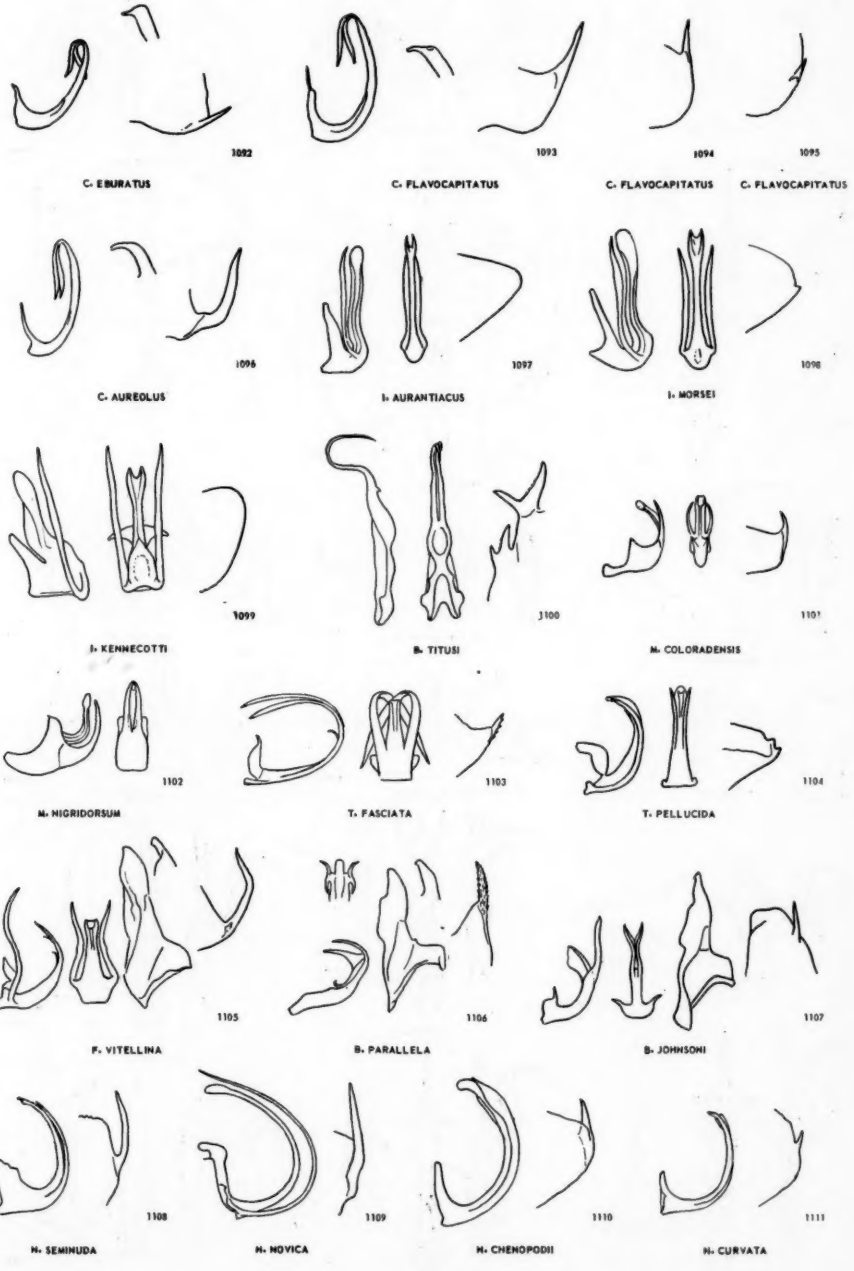
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B. TITUSI
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M. COLORADENSIS
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M. NIGRIDORSUM
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T. FASCIATA
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T. PELLUCIDA
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B. PARALLELA
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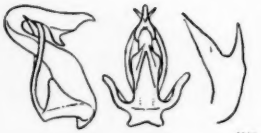
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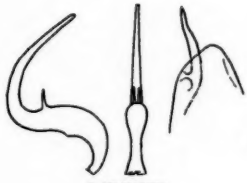
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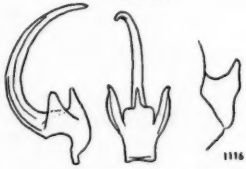
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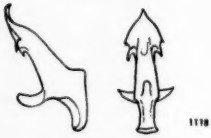
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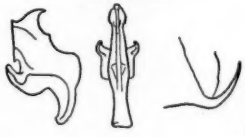
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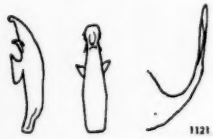
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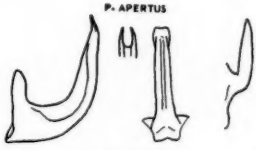
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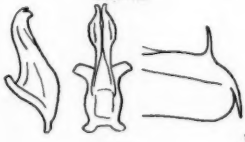
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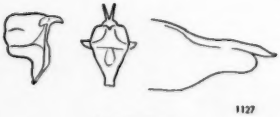
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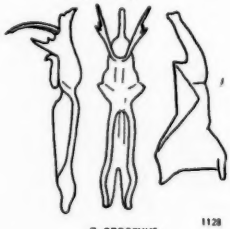
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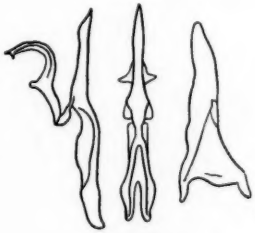
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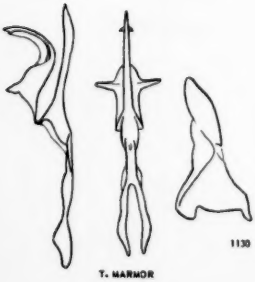
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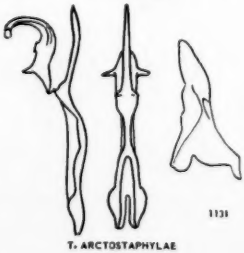
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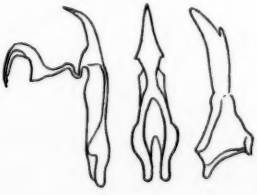
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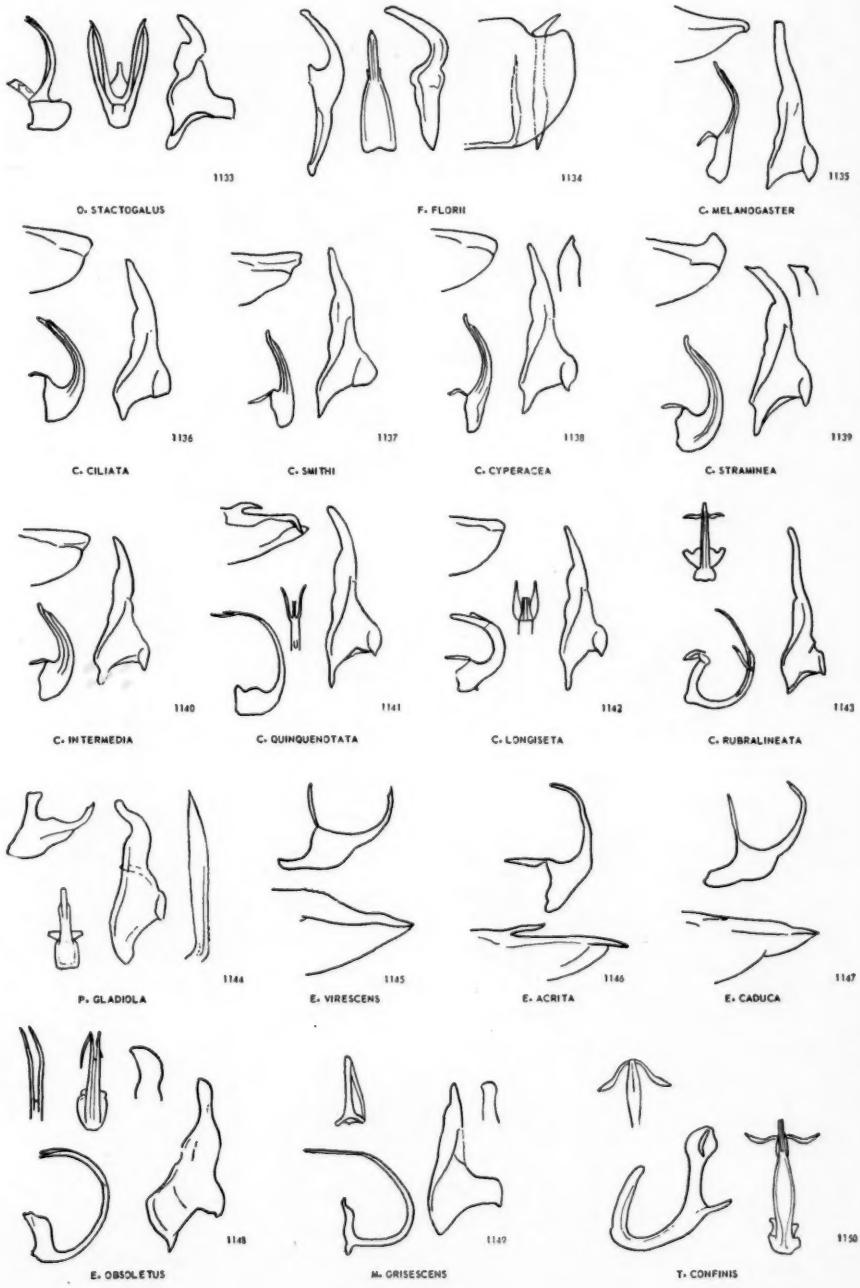
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C. SMITHI
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C. CYPERACEA
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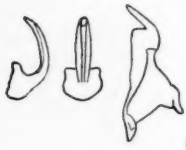

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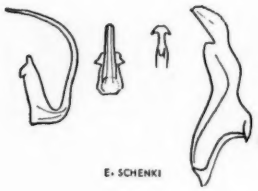

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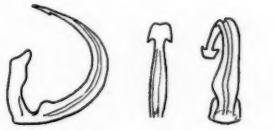

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1154

S. SORDIDUS

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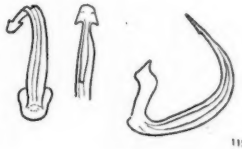

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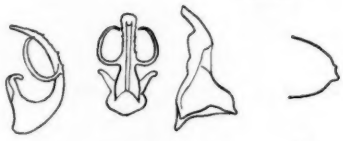

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F. FRIGIDUS



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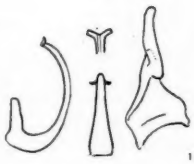

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L. ATRICAPILLIS

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L. NIGRAX

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L. UNEOLUS

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L. PARALLELUS

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S. VACCINII

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S. DASIDUS

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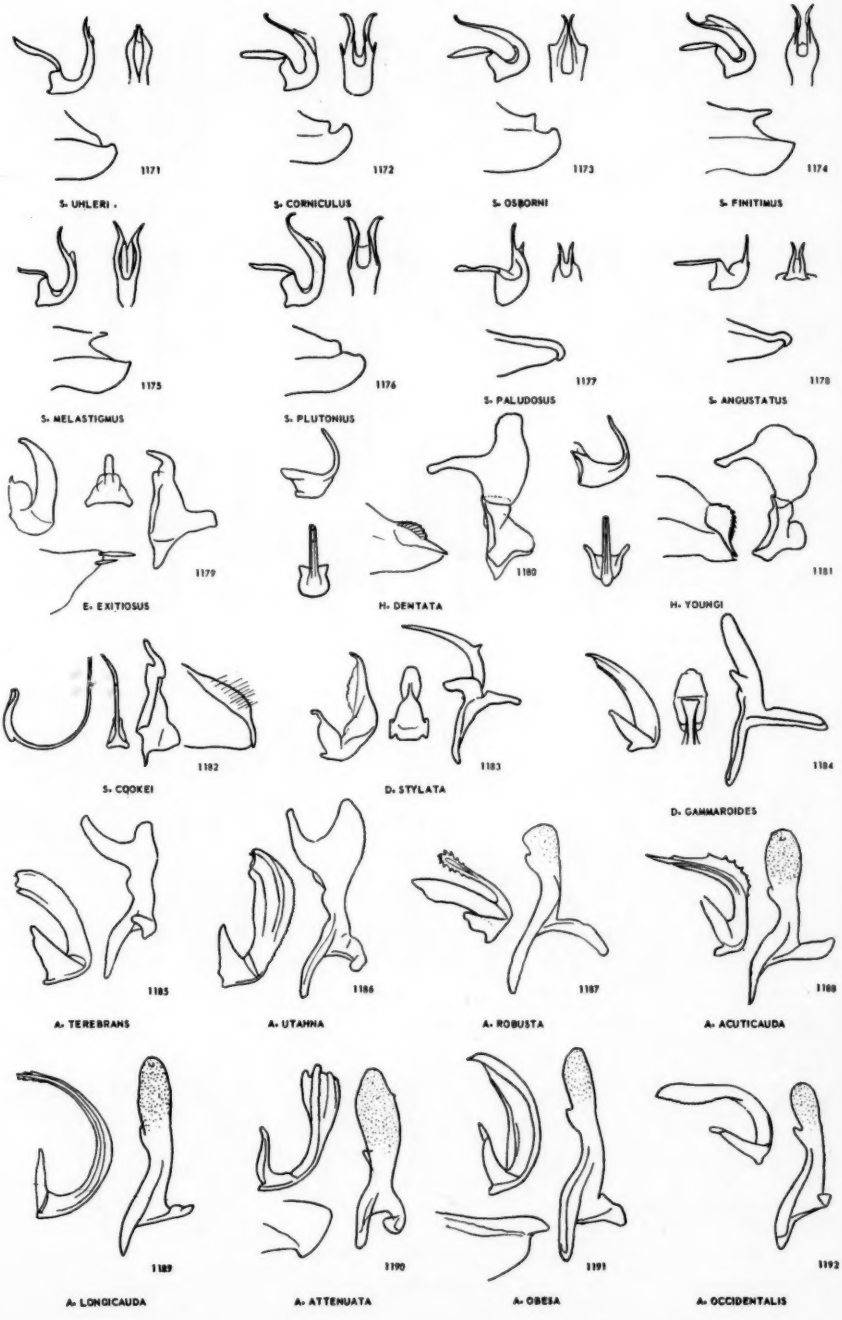
S. OMANI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1176
S. PLUTONIUS
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S. PALUDOSUS
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S. ANGUSTATUS
1179
E. EXITIOSUS
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H. DENTATA
1181
H. YOUNGI
1182
S. COOKEI
1183
D. STYLATA
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D. GAMMAROIDES
1185
A. TEREBRANS
1186
A. UTAHNA
1187
A. ROBUSTA
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1192
A. OCCIDENTALIS

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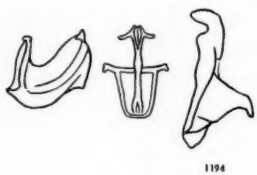

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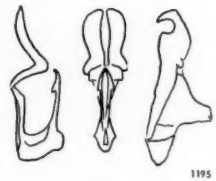

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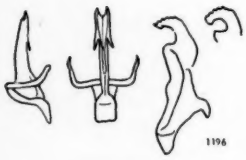

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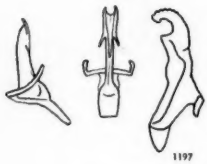

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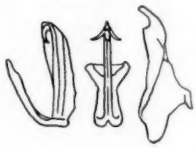

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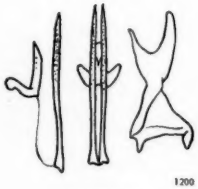

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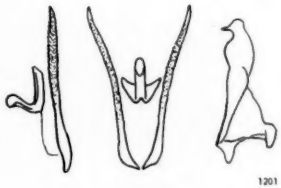

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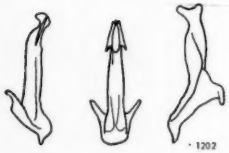

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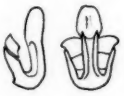

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P. LAPPONICUS

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P. CEPHALOTES

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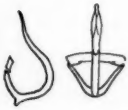
P. DENTATUS



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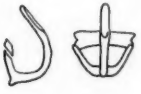

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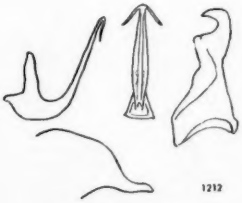

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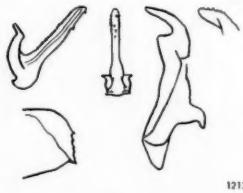

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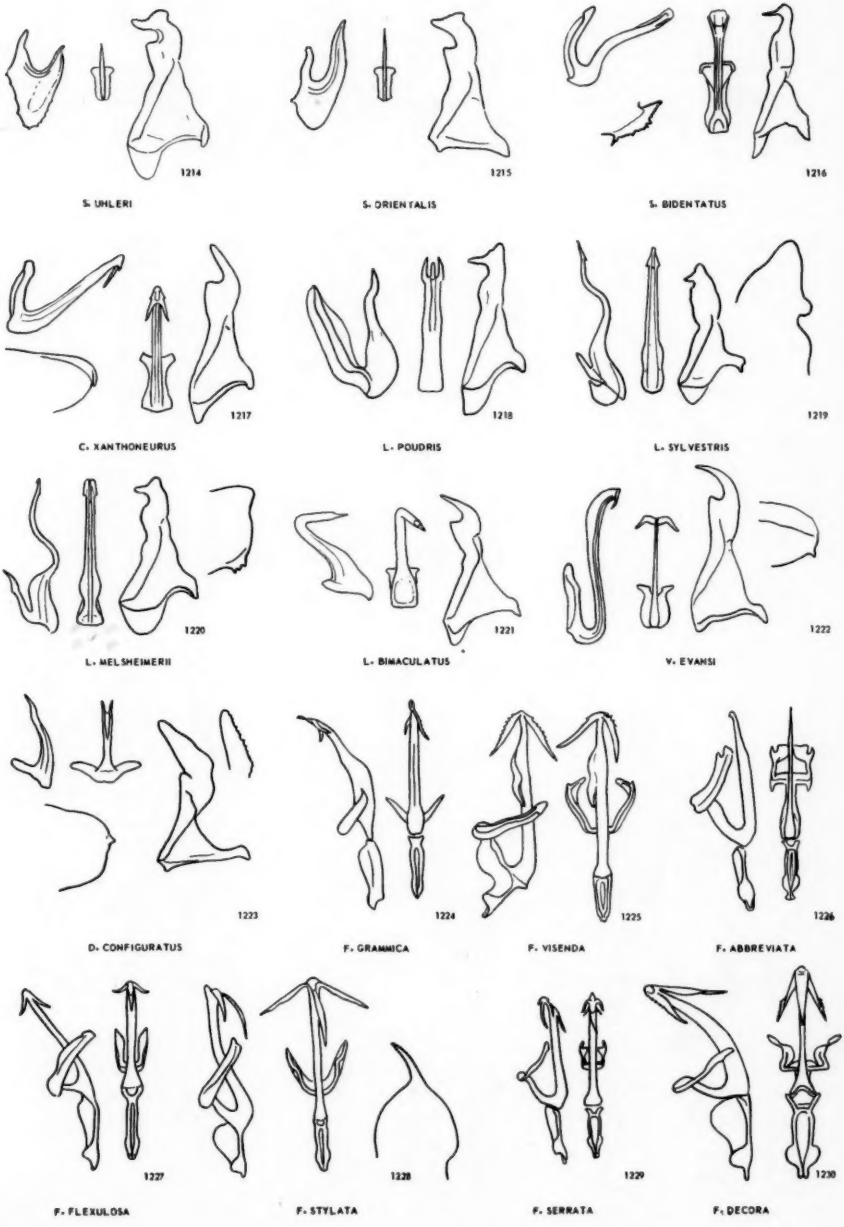
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1219
L. SYLVESTRIS
1220
L. MELSHEIMERII
1221
L. BIMACULATUS
1222
V. EVANSI
1223
D. CONFIGURATUS
1224
F. GRAMMICA
1225
F. VISENDA
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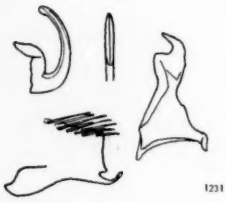
F. DECORA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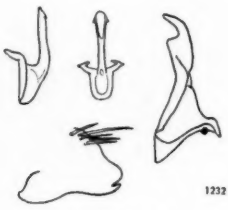
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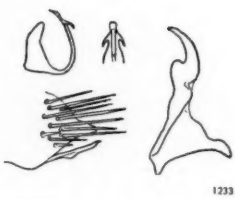
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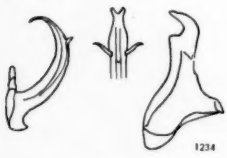
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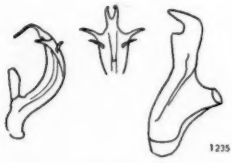
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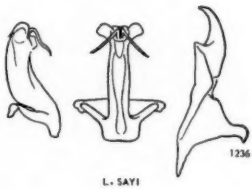
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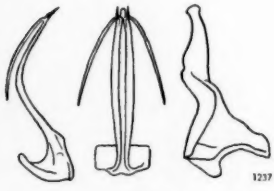
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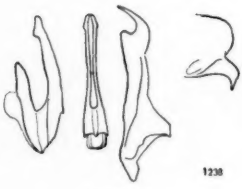
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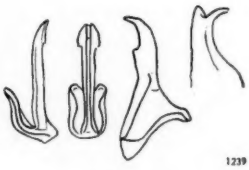
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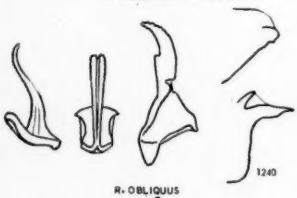
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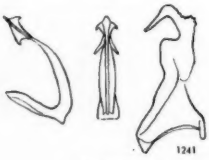
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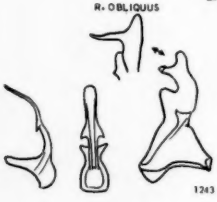
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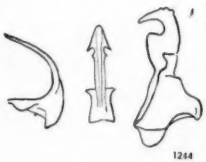
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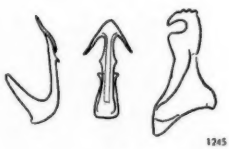
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H. OCCIDENTALIS

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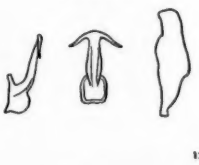
H. ROSTRATUS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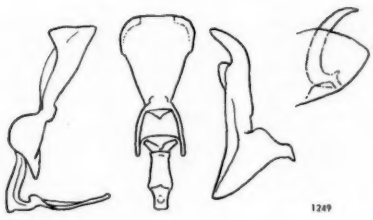

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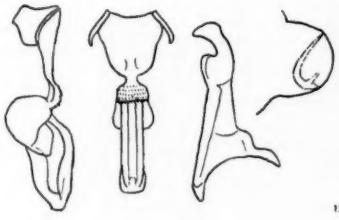

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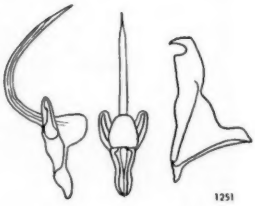

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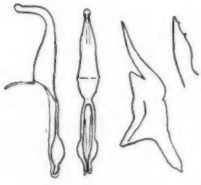

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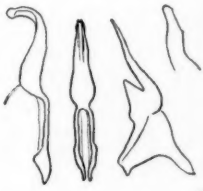

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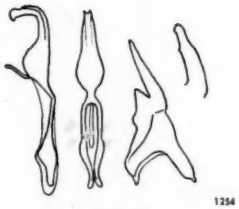

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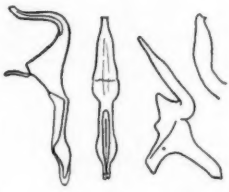

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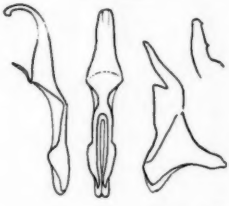

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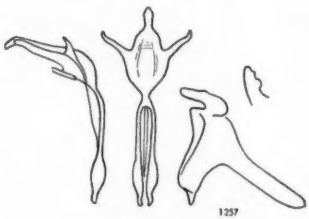

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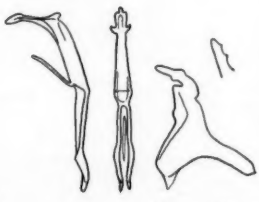

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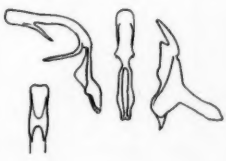

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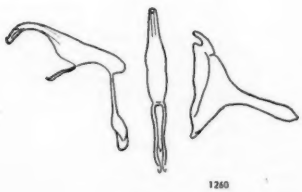

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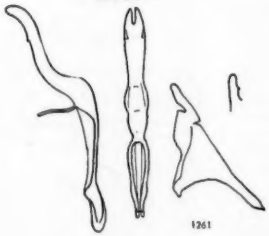
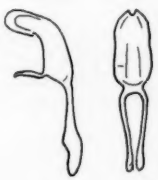


1261

E. INIMICA



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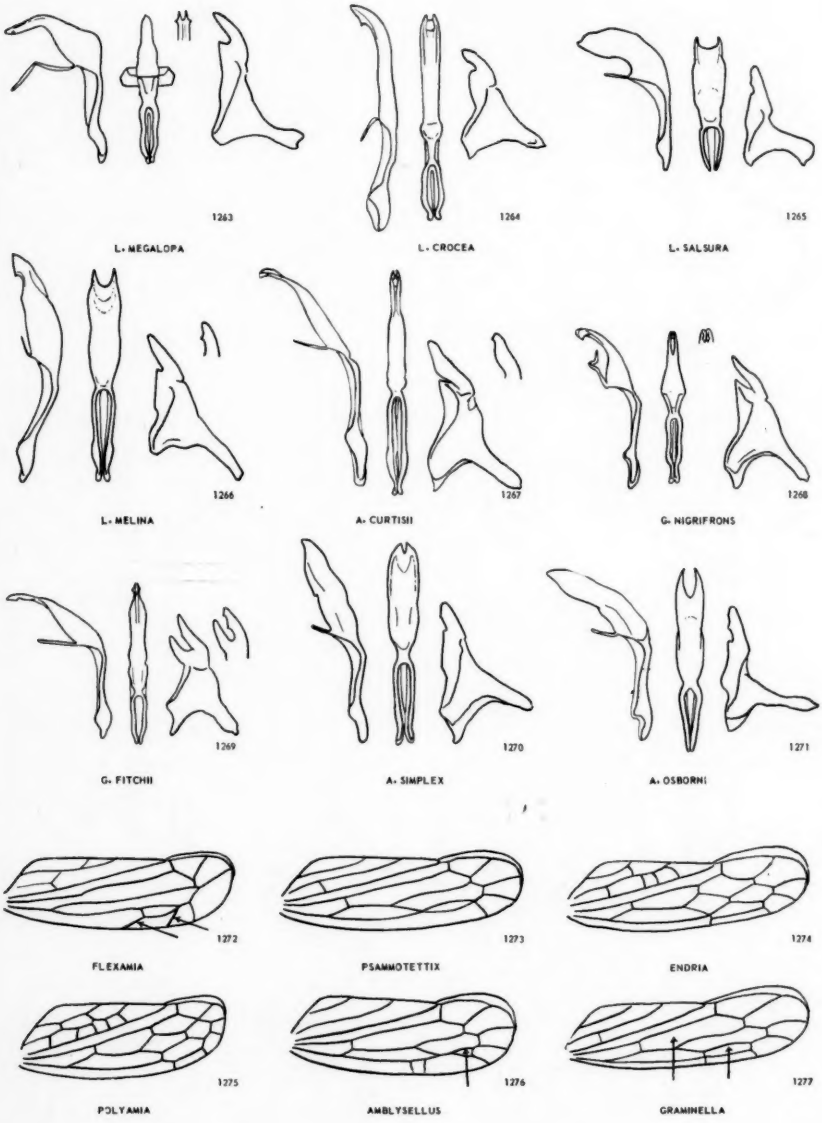
E. ROTUNDA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